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Articles PAGE

John Stanley Plaskett (with Plate XII) ..... *C. S. Beals* 401
A Bibliography of the Published Papers of J. S. Plaskett ..... *C. S. Beals, R. M. Petrie, K. O. Wright* 408
J. S. Plaskett at the University of Toronto (with Plate XIII) ..... *C. A. Chant* 412
The Satellites of Jupiter (with Plate XIV) ..... *Seth B. Nicholson* 415
Mars, la Planète étrange ..... *Albéric Boivin* 421
Henry Allen McTaggart ..... *E. F. Burton* 428

Review of Publications

Observations of Mars and its Canals, by Harold B. Webb (*Hugh M. Johnson*); Sky and Telescope (*F.S.H.*) 431

Notes and Queries

The Quebec Astronomical Society—Death of G. Parry Jenkins—Founding of the Yerkes Observatory—Removal of Reflections from the Surface of Lenses ..... *C.A.C.* 433

Meetings of the Society

At Winnipeg 437
Summer Evenings with the Stars—Victoria, 1941 ..... *K. O. Wright* 438

Index to Volume XXXV 441

Table of Contents for Volume XXXV, 1941 (at end) ..... i-v

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PLATE XII

JOHN STANLEY PLASKETT
November 17, 1865—October 17, 1941.
(Cherer Studio, Victoria, B.C.)

PLATE XIII

JOHN S. PLASKETT (about 1897)

At the table in his workshop at the University of Toronto.

(Photograph by A. H. Abbott)

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JOHN STANLEY PLASKETT

By C. S. BEALS

(With Plate XII)

THE death of Dr. John Stanley Plaskett at his home in Esquimalt on October 17, 1941, not only brought to a close a distinguished and colourful scientific career but also removed a great and lovable personality, a personal loss which will be deeply felt by his colleagues and friends all over the world. Plaskett's scientific activities spanned the first four decades of the present century and during that time he not only took a leading part in the international organization of astronomy but his personal contributions to the advancement of science ranked high among those which made this a notable period in astrophysical research. Entering the field of astronomy relatively late in life, he turned every previous experience to advantage and soon attained a position where his own exceptional abilities had fullest scope and where, by his efforts in founding a great modern observatory, he was able to place unusual opportunities for research in the hands of others.

His early life was of a pattern with that of many another successful man of his time. He was born on a farm in the village of Hickson in Oxford county, in southern Ontario. He attended the elementary school of the village and later the high school in the neighbouring town of Woodstock. The eldest of a large family, he early knew the meaning of responsibility and for a time helped in the management of the farm. Farming was not his choice for a life work, however, and as soon as arrangements could be made he left the farm and took up machine work with a local engineering firm

in Woodstock. From there he went to the Edison Company in Schenectady, New York, returning to Canada with the Canadian Edison Company in Sherbrooke, Quebec, in 1889. In 1890 he joined the staff of Toronto University as foreman of the workshop and lecturer's assistant. Here one of his duties was the preparation of apparatus for lecture-room demonstration and in the course of this work he rapidly added to his knowledge of physics and was confirmed in his desire for a more complete scientific education. With this object in view he enrolled as a student of the University in 1895 and graduated with high honours in physics and mathematics in 1899.

Plaskett's marriage to Rebecca Hope Hemley took place in 1892. The marriage was a happy one and he has spoken many times with deepest appreciation of the encouragement and inspiration given by his wife during his early efforts to complete his education as well as later in his astronomical work. Two children were born of the marriage, Harry Hemley, Savilian Professor of Astronomy at Oxford University, and Stuart S. now living in Victoria, British Columbia.

He continued his connection with the University until 1903 and during this period he made extensive experiments with three-colour photography and in this field as well as in that of landscape photography he acquired a mastery of technique which was to stand him in good stead in his later work as an astronomer.

In 1903 he received an appointment with the Astronomical Branch of the Department of the Interior at Ottawa. At this time a new Observatory was planned and Plaskett gave invaluable assistance to the Chief Astronomer, Dr. W. F. King, in problems of instrumental design and construction. His first really heavy task in his new position came, however, when he was placed in charge of the observations to be made of the eclipse of the sun on August 30, 1905, and the manner with which he performed this task gave a clear indication of his scientific abilities. His report to the Chief Astronomer describing the planning of the observations, the design and assembling of the apparatus and the actual journey to Labrador and back is a truly remarkable document which leaves no doubt in the mind of the reader of the unusual qualities of mind of the man responsible for it. These qualities are shown not only in the thoroughness and care with which the observational equipment was

prepared but also the careful thought given to the nature of the observations to be made. Avoiding duplication of early work he concentrated his instrumental facilities on the observation of the corona. Four cameras were provided for the photography of the corona in light of different colours, two objective spectrographs were arranged to observe both corona and chromosphere while a three-prism slit-spectrograph was set up to study the wave-lengths of lines in the coronal spectrum.

In spite of all the labour and care which went into the preparation of the expedition, observations were prevented by cloudy weather. The energy expended was by no means wasted, however, as valuable experience with apparatus had been gained and the excellent cœlostat, as well as other instruments acquired for the eclipse, were later incorporated into the equipment of the newly built Dominion Observatory at Ottawa.

Plaskett was placed in charge of the astrophysical work at Ottawa and as soon as the work of installation was completed he set to work with characteristic industry and care to test the suitability of the equipment for the work in hand. His main interest was in spectroscopy and he soon found that the stellar spectrograph attached to the 15-inch equatorial suffered from numerous defects, the most serious of which was mechanical flexure, causing a displacement of the spectral lines between the beginning and the end of an exposure. He concluded almost immediately that a new spectrograph was the only solution and the next two years were spent in an exhaustive study of the mechanical design of spectrographs, the optical properties of prisms and lenses and the design and position of the correcting lens necessary in order to use a spectrograph with a visual refractor. For the purpose of these studies he visited most of the prominent American observatories in the summer of 1906. The result was a new spectrograph incorporating the best mechanical and optical ideas of the time, which gave excellent performance and which utilized with maximum efficiency the relatively small light-gathering power of the telescope.

The new spectrograph was built in the Observatory workshop and could be used in both one- and three-prism forms. Upon its completion in 1907 an extensive program of spectrographic observa-

tions was instituted. This program consisted mainly of the study of stellar radial velocities though a number of other special investigations, including the observation of Omicron Ceti and Nova Geminorum were also made. Sharing in the work were W. E. Harper, J. B. Cannon and T. H. Parker. The observations of radial velocity were applied mainly to the study of spectrographic binary orbits and the work was pushed so energetically that the Ottawa Observatory was soon in the front rank of institutions engaged in this particular branch of astrophysical research.

As the work at Ottawa proceeded and several thousand spectrograms were secured, it gradually became clear that the number of stars which could be efficiently observed with the 15-inch refractor was very limited and would be practically exhausted in a very few years. Such a situation constituted a challenge to which Plaskett reacted in characteristic fashion. He had recently attended the meetings of the International Union for Co-operation in Solar Research at Pasadena in the year 1910 where he had seen and admired the beautiful 60-inch reflecting telescope of the Mount Wilson Observatory. He saw clearly that only a telescope of equal or greater size would suffice to carry out an extensive program of radial velocity measures of faint stars and in his report to the Chief Astronomer for the year 1911 he strongly recommended the erection of a large reflecting telescope with an aperture of six feet or more.

A lesser man would have been discouraged by the difficulties of such a project but Plaskett knew himself to be more than equal to the task of design and organization and was quite ready to tackle the more difficult question of finance. The permission of Parliament was necessary in order to finance such as ambitious undertaking, so that not only department heads but also members of parliament had to be persuaded of the value of the work. The Chief Astronomer, Dr. W. F. King, gave the project his strongest support and encouragement but the major part of the work of securing the necessary parliamentary support was done by Plaskett. For this necessary task his perseverence and enterprise and his wide knowledge of all aspects of Canadian life and work made him specially suited, while his genial manner, hearty laugh and fondness for a good story were certainly no handicaps in negotiations involving personal contacts

with members of parliament and officials from all parts of Canada. Detailed accounts of the various steps of the negotiations have been given elsewhere. Here it suffices to say that success was finally achieved and contracts were awarded for the construction of a 72-inch reflecting telescope in the year 1913.

The contract for the mechanical parts of the telescope was awarded to the Warner and Swasey Company of Cleveland, Ohio, while the grinding and figuring of the mirror was entrusted to the John A. Brashear Company of Pittsburgh, Pa. The glass disc for the 72-inch mirror was cast by the St. Gobain Glass Company of Liege, Belgium, and was fortunately shipped to America in 1914, shortly before Belgium was engulfed by the war. Plaskett watched over the various processes that went into the creation of the telescope with the most loving care and his association with Mr. Brashear and with the heads of the Warner and Swasey Company resulted in warm friendships which lasted throughout life.

As a result of a study of atmospheric conditions across Canada made by Mr. W. E. Harper in 1915 it was decided to locate the new telescope in Victoria, B.C. Construction of the building was started in the fall of 1915, and the observatory was finally completed in 1918. Plaskett became the first director with R. K. Young as his assistant. They were joined in 1919 by W. E. Harper, by H. H. Plaskett in 1920 and by J. A. Pearce in 1924. Others who joined the astronomical staff during Plaskett's directorship were S. N. Hill, C. S. Beals, F. S. Hogg and R. O. Redman.

The program of observation initiated by Plaskett in 1918 was mainly concerned with the radial velocities of a large number of stars of miscellaneous spectral type for which the proper motions were known. This choice of program was a logical consequence of his earlier work at Ottawa and of his chairmanship of the radial velocity committee of the International Astronomical Union, an office which he held for six years. Most of the observations were made with one-prism dispersion and the small exposure times made possible by the 72-inch mirror resulted in a rapid accumulation of data, some 9,000 spectrograms being secured during the first five years. At first principal emphasis was placed on the study of binary orbits but it

was later recognized that the space-motions of the distant early type stars and of interstellar matter constituted an even more interesting problem. With the able collaboration of Dr. J. A. Pearce who, as stated above, joined the staff in 1924, Plaskett made the first extensive observational test of the rotation of the galaxy, employing the relations developed by Oort in 1928. Their results for the motions of both stars and interstellar matter established beyond question the reality of the galactic rotation, and by making use of the appropriate data on proper motions they were able to calculate the period of revolution and the distance of the sun from the galactic centre. These results represented a remarkable step forward in our knowledge of the galactic system and constituted a solid foundation on which many additional investigations have been based since that time.

The completion of the work on galactic rotation brought wide international recognition and Plaskett had the satisfaction of receiving numerous honours and awards in recognition of a distinguished lifetime devoted to astrophysical research. Probably the one he prized most was the Gold Medal of the Royal Astronomical Society. He also received the Rumford Medal of the American Academy of Arts and Sciences, Boston, Mass., the Bruce Medal of the Astronomical Society of the Pacific, the Flavelle Medal of the Royal Society of Canada and the Henry Draper Medal of the National Academy of Sciences, Washington, D.C. He was also the recipient of honorary degrees from the Universities of Pittsburgh, Toronto, British Columbia, McGill and Queen's.

One of the aspects of Plaskett's life in Victoria in which he took the greatest satisfaction was his association in astronomical work with his son, H. H. Plaskett, who was a member of the staff from 1920 to 1929. Father and son were always very devoted and although they followed different lines of work each derived much help and inspiration from the other. After H. H. Plaskett's departure from Victoria to go first to Harvard and later to Oxford, England, they kept up a lively correspondence dealing with many branches of astrophysical work.

Plaskett retired from the directorship of the Dominion Astrophysical Observatory in 1935 but his interest in astrophysics continued as keen as ever. For several years he held a post as scientific

consultant to the Warner and Swasey Company. In this capacity he supervised the final figuring and testing of the 82-inch mirror for the McDonald Observatory which was completed in 1938. Whenever possible he made weekly visits to the observatory in Victoria and up to the time of his death he continued to take an active interest in the work being carried on by various members of the staff.

The salient characteristics of Plaskett's character as revealed by day to day association with him in the observatory work were tolerance, humour, and interest in his fellow men. In his administrative work he believed that tact and persuasion were more effective than rigid discipline and his relations with subordinates were always characterized by courtesy and consideration. He knew how to enjoy life and the writer has never known a man who was able to extract more genuine satisfaction from his later years. He loved company and was never happier than when in the midst of an informal gathering of scientific colleagues or friends. He had many friends and interests outside his profession and was regarded with respect and affection by many who knew little or nothing of his scientific activities.

During the past year Plaskett's friends in Victoria became aware with very deep regret that his health was rapidly failing. His growing physical weakness made no difference to his happy disposition, however, and it was apparent to all that he was facing the end with the same cheerful courage with which he had always faced the tasks of life. His faculties were undimmed to the last and his sudden and quiet passing on October 17th of this year was a fitting close to a life full of active achievement.

Dominion Astrophysical Observatory,
Victoria, B.C.
November 19, 1941.

BIBLIOGRAPHY OF THE PUBLISHED PAPERS OF J. S. PLASKETT

Prepared by C. S. Beals, R. M. Petrie and K. O. Wright

Plates and Filters for Monochromatic and Three Colour Photography of the Corona. Trans. R.A.S.C., p. 89, 1905.

Report on Solar Eclipse Expedition 1905. Report of the Chief Astronomer, p. 213, 1905.

Observatory Instruments and Astrophysical Work. Report of the Chief Astronomer, p. 39, 1906.

The Character of the Star Image in Spectrographic Work. Jour. R.A.S.C., vol. 1, p. 297, 1907; Astroph. Jour., vol. 25, p. 195, 1907; vol. 27, p. 139, 1908.

The Spectrum of Mira Ceti. Jour. R.A.S.C., vol. 1, p. 45, 190.

Adapting a Universal Spectroscope for Radial Velocity Determinations. Jour. R.A.S.C., vol. 1, p. 104, 1907.

The Spectroscopic Binary Iota Orionis, (with W. E. Harper), Astroph. Jour., vol. 27, p. 272, 1908.

The Orbit of Iota Orionis. Astroph. Jour., vol. 28, p. 274, 1908.

The Spectroscopic Binary Psi Orionis. Astroph. Jour., vol. 28, p. 266, 1908.

The Effect of Increasing the Slit Width on the Accuracy of Radial Velocity Determinations. Astroph. Jour., vol. 28, p. 259, 1908; vol. 32, p. 230, 1910; Jour. R.A.S.C., vol. 4, p. 333, 1910.

Camera Objectives for Spectrographs. Astroph. Jour., vol. 29, p. 258, 1909.

The Spectroscopic Binary Beta Orionis. Astroph. Jour., vol. 30, p. 26, 1909.

Two Curiously Similar Spectroscopic Binaries (with W. E. Harper). Astroph. Jour., vol. 30, p. 373, 1909.

The Design of Spectrographs for Radial Velocity Determinations. Jour. R.A.S.C., vol. 3, p. 190, 1909; Report of Chief Astronomer, p. 152, 1909.

The Ottawa Spectrograph. Jour. R.A.S.C., vol. 3, p. 287, 1909.

Collimation of the Correcting Lens. Astroph. Jour., vol. 32, p. 243, 1910.

The Spectroscopic Binary Epsilon Ur. Min. Jour. R.A.S.C., vol. 4, p. 460, 1910.

Some Recent Interesting Developments in Astronomy. Jour. R.A.S.C., vol. 5, p. 245, 1911.

The Spectrum of Nova Geminorum. Jour. R.A.S.C., vol. 6, p. 27, 1912. Pub. Dom. Obs., vol. 1, p. 159, 1912.

The Spectroscopic Binary θ^2 Tauri. Jour. R.A.S.C., vol. 6, p. 231, 1912.

The Solar Radiation. Science, vol. 35, p. 708, 1912.

The Great Reflector for Canada. Jour. R.A.S.C., vol. 7, p. 448, 1913.

The 72-inch Reflecting Telescope. Jour. R.A.S.C., vol. 8, p. 180, 1914; vol. 10, p. 275, 1916; vol. 12, p. 397, 1918.

The Solar Rotation in 1911 (with R. E. Delury). Astroph. Jour., vol. 37, p. 73, 1913.

The Plane Grating for Stellar Spectroscopy. Astroph. Jour., vol. 37, p. 373, 1913.

Experiments Regarding the Efficiency of Spectrographs.. Pub. Dom. Obs., vol. 2, p. 173, 1914.

Improvements in the Optical System of the Stellar Spectrograph. Astroph. Jour., vol. 40, p. 127, 1914.

The Spectroscopic Determination of the Solar Rotation at Ottawa. Astroph. Jour., vol. 42, p. 373, 1915; Jour. R.A.S.C., vol. 10, p. 170, 1916.

The Spectroscopic Binary θ^2 Tauri. Pub. Dom. Obs., vol. 2, p. 63, 1915.

The Siderial Universe. Jour. R.A.S.C., vol. 9, p. 37, 1915.

Modern Views of the Sun. Jour. R.A.S.C., vol. 10, p. 101, 1916.

W. F. King. Jour. R.A.S.C., vol. 10, p. 267, 1916.

Notes on the Spectrum of Nova Aquilae No. 3. Jour. R.A.S.C., vol. 12, p. 350, 1918.

The Stellar Spectroscope of the 72-inch Reflecting Telescope. Astroph. Jour., vol. 49, p. 209, 1919.

The Spectroscopic Binary H.R. 8170. Jour. R.A.S.C., vol. 13, p. 174, 1919. Pub. Dom. Astroph. Obs., vol. 1, p. 113, 1919.

The Optical Parts of the 72-inch Telescope. Jour. R.A.S.C., vol. 14, p. 177, 1920. Astroph. Jour., vol. 59, p. 65, 1924.

The Spectroscopic Orbits and Dimensions of the Eclipsing Varibles U Ophiuchi R S Vulpeculae and T W Draconis. Jour. R.A.S.C., vol. 14, p. 1, 1920; Pub. Dom. Astroph. Obs., vol. 1, p. 137, 1920.

Description of Building and Equipment. Pub. Dom. Astroph. Obs., vol. 1, p. 7, 1920.

The Spectroscopic Orbit of U Coronae. Pub. Dom. Astroph. Obs., vol. 1, p. 187, 1920.

One Hundred Spectroscopic Binaries (with W. E. Harper, R. K. Young, and H. H. Plaskett). Pub. Dom. Astroph. Obs., vol. 1, p. 163, 1920.

The Spectroscopic Orbit of T X Hercules. Pub. Dom. Astroph. Obs., vol. 1, p. 207, 1920.

The Spectroscopic Orbit of Y Cygni. Pub. Dom. Astroph. Obs., vol. 1, p. 213, 1920.

The Spectroscopic Orbit and Dimensions of Z Vulpecula. Pub. Dom. Astroph. Obs., vol. 1, p. 251, 1921.

The Dominion Astrophysical Observatory. Monthly Notices R.A.S., vol. 80, p. 392, 1920.

Eighty-Eight Spectroscopic Binaries (with W. E. Harper, R. K. Young, and H. H. Plaskett). Pub. Dom. Astroph. Obs., vol. 1, p. 287, 1922.

Temperature Regulation of Spectrograph and Mirror. Jour. R.A.S.C., vol. 16, p. 91, 1922.

The Star of Greatest Known Mass. Jour. R.A.S.C., vol. 16, p. 284, 1922.

A Very Massive Star. Monthly Notices R.A.S., vol. 82, p. 447, 1922.

The Radial Velocities of 594 Stars (with W. E. Harper, R. K. Young, and H. H. Plaskett). Pub. Dom. Astroph. Obs., vol. 2, p. 3, 1921.

The Spectroscopic Orbit of T V Cassiopeia. Pub. Dom. Astroph. Obs., vol. 2, p. 141, 1922.

The Spectroscopic Orbit of B. D. 6° 1309. Pub. Dom. Astroph. Obs., vol. 2, p. 147, 1922.

The Spectroscopic Orbit of 44° 3639. Pub. Dom. Astroph. Obs., vol. 2, p. 183, 1922.

The Spectroscopic Orbit of 56° 2617. Pub. Dom. Astroph. Obs., vol. 2, p. 269, 1923.

The O-Type Stars. Pub. Dom. Astroph. Obs., vol. 2, p. 287, 1924.

The H and K Lines of Calcium in O-Type Stars. Monthly Notices R.A.S., vol. 84, p. 80, 1923.

The Work of the 72-inch Telescope. Jour. R.A.S.C., vol. 18, p. 169, 1924.

James B. McDowell, an Appreciation. Jour. R.A.S.C., vol. 18, p. 185, 1924.

The O-Type Stars and Their Relation to the Stellar Evolutionary Sequence. Jour. R.A.S.C., vol. 18, p. 321, 1924.

The Orbits of Two Double Lined B-Type Binaries. Pub. Dom. Astroph. Obs., vol. 3, p. 179, 1925.

Three Spectroscopic Binary Orbits. Pub. Dom. Astroph. Obs., vol. 3, p. 247, 1926.

Note on Three Peculiar Spectra. Monthly Notices R.A.S., vol. 87, p. 31, 1926.

The Dominion Astrophysical Observatory. Pub. Ast. Soc. Pac., vol. 39, p. 88, 1927.

Sixty Years Progress in Astronomy. Jour. R.A.S.C., vol. 21, p. 295, 1927.

Three Peculiar Spectra. Pub. Dom. Astroph. Obs., vol. 4, p. 1, 1926.

Two Spectroscopic Orbits and Notes on Upsilon Sagittarii. Pub. Dom. Astroph. Obs., vol. 4, p. 103, 1928.

The Rotation of the Galaxy. Monthly Notices R.A.S., vol. 88, p. 395, 1928.

The Motions of the Stars. Jour. R.A.S.C., vol. 22, p. 111, 1928.

The High Temperature Stars (George Darwin Lecture). Monthly Notices R.A.S., vol. 90, p. 616, 1930.

The Motions and Distribution of Interstellar Matter (with J. A. Pearce). Monthly Notices R.A.S., vol. 90, p. 243, 1930.

The Structure and Rotation of the Galaxy. Proc. Am. Phil. Soc., vol. 69, p. 401, 1930.

The Motions of the B Stars. Science, vol. 71, p. 225, 1930.

A Review of the Progress of Astronomy. Pub. Ast. Soc. Pac., vol. 44, p. 215, 1932.

The Radial Velocities of 523 O- and B-Type Stars Obtained at Victoria (with J. A. Pearce). Pub. Dom. Astroph. Obs., vol. 5, p. 1, 1930.

A Catalogue of the Radial Velocities of O- and B-Type Stars (with J. A. Pearce). Pub. Dom. Astroph. Obs., vol. 5, p. 99, 1930.

The Structure and Rotation of the Galaxy. Pub. Ast. Soc. Pac., vol. 44, p. 141, 1932.

The Expansion of the Universe. Jour. R.A.S.C., vol. 27, p. 235, 1933.

Observational Confirmation of the Rotation of the Galaxy. Observatory, vol. 56, p. 328, 1933.

The Problems of the Diffuse Matter in the Galaxy (with J. A. Pearce). Pub. Dom. Astroph. Obs., vol. 5, p. 167, 1931.

The Distance and Direction to the Gravitational Centre of the Galaxy from the Motions of the O5 to B7 Stars (with J. A. Pearce). Monthly Notices R.A.S., vol. 94, p. 679, 1934.

The Dimensions and Structure of the Universe (Halley Lecture). Oxford University Press, 1935; Jour. R.A.S.C., vol. 30, p. 153, 1936.

The Motions of the O- and B-Type Stars and the Scale of the Galaxy (with J. A. Pearce). Pub. Dom. Astroph. Obs., vol. 5, p. 241, 1934.

Ambrose Swasey, Engineer, Scientist, Philanthropist. Jour. R.A.S.C., vol. 31, p. 409, 1937.

Edward P. Burrell. Pub. Ast. Soc. Pac., vol. 49, p. 141, 1937.

An Analysis of the K-Term in the B-Type Stars. Monthly Notices R.A.S., vol. 98, p. 518, 1938.

The 82-inch Mirror of the McDonald Observatory. Astroph. Jour., vol. 89, p. 84, 1939.

JOHN S. PLASKETT AT THE UNIVERSITY OF TORONTO

By C. A. CHANT

(With Plate XIII)

THE Physical Laboratory of the University of Toronto was established in 1878. In addition to an excellent collection of apparatus suitable for lecture demonstrations, it contained many pieces designed for individual experiments in the various branches of physics. The equipment had been purchased chiefly in Paris by James Loudon, who was Professor of Mathematics and Natural Philosophy from 1876 up to 1887 when his title was changed to Professor of Physics. In 1892 he became President of the University and served in that capacity until 1906. He died in 1920.

In 1889 the staff in the Department of Physics consisted of James Loudon, Professor; his nephew, William James Loudon, Demonstrator; and a Fellow appointed for the session and chiefly employed in teaching. There was also a handy-man who acted as a general helper. W. J. Loudon later became Professor of Mechanics, and, although he retired over ten years ago, is still active in mind and body.

Instruction in experimental physics had been steadily growing, and for this a workshop is a necessity. Professor W. J. Loudon informs me that in the fall of 1889 when in Montreal he met by chance R. A. Ross and J. S. Plaskett. Ross was born August 29, 1865, in Woodstock, whence Plaskett came, and had been for two years a student at the School of Practical Science, which later became the Faculty of Applied Science and Engineering of the University. He was about to begin his third and final year. In after years he became a distinguished engineer in Montreal, and he died in 1936. He and Plaskett had just returned from the United States where they had been working in the Edison Machine Works which in 1886 had been moved from New York City to Schenectady. It may be stated here that in 1887 Edison established his laboratory and headquarters in West Orange, N.J., where the headquarters of the Edison industries still remain. The well-known General Electric Company was formed on April 12, 1892, by the union of the Edison General Electric Company of

Schenectady, N.Y., and the Thomson-Houston Company of Lynn, Mass. Professor Loudon is under the impression that Ross and Plaskett had been at the West Orange plant; but Dr. Beals in his obituary notice in this issue, with Mrs. Plaskett and a brother of Dr. Plaskett as sources of information, gives Schenectady as the place where Plaskett had been. At any rate he was looking for a position. He was directed to Professor James Loudon, who offered him the position of Mechanician in the Department of Physics, his duties to include assisting in lecture demonstrations.

The session 1889-90 was my final one in the B.A. course. My recollection is that Plaskett began his services in the autumn of 1889, but it may have been in January, 1890. Thus far I have not been able to locate any official record of his appointment. On February 14, 1890, there was a disastrous fire at the University. It occurred on the evening of the Annual Conversazione, the big social event of the Literary and Scientific Society, the chief student organization. Among the features of the evening were exhibits in physics and the other sciences. I had prepared some experiments in sound, and near by were some electrical exhibits for which, as I remember it, Plaskett and his friend Ross were largely responsible. There were some showy experiments and when the student and his "girl friend" (though that phrase was not common then) came up to see them and leaned against the protecting railing they received an electrical shock from an induction coil.

At that time the Department of Physics was on the ground floor of the west portion of the Main Building, and the workshop was in the basement. An "Otto" gas-engine served as source of power, but the equipment was meagre. When the building was reconstructed after the fire, a real machine shop was provided on the north side of the quadrangle over a new heating plant. In the latter was a steam engine which drove a dynamo which supplied current for the lighting system and for some experiments in the laboratory. Before the fire there were sparse gas-lights in the corridors and in a few rooms, but there was no general illumination of the building and the attempt to supply this by oil lamps on the night of the conversazione led to the fire.

Among the apparatus was a self-regulating carbon arc lamp which was used for lantern slides and experiments in the lectures. It had displaced an oxy-hydrogen lime-light outfit, the gas-bags

for which were still "kicking round" the place. To supply current for the arc lamp a large battery of Grove cells was used. Every time the lantern was required this battery had to be prepared afresh. It was messy and costly, and one of the first things Plaskett did was to construct a dynamo of suitable voltage and output to replace the battery. It was driven by the "Otto" engine. He designed the dynamo, made the patterns and built the machine. It resembled the regular Edison type with vertical field-magnets. His experience in the Edison shop served him well.

When assisting in lectures, Plaskett was not a listless helper but was alert to understand what was under discussion. He was also on familiar terms with the staff and students in the Mathematics and Physics course, and in a few years made up his mind that he would take the course himself. Of this determination the staff cordially approved. So he first obtained matriculation, and then in October, 1895, enrolled as a student in Arts in the University. In May, 1896, he wrote his first examination and obtained fourth place in Class I. In each of the next three years he ranked second in Class I. In the first, second and third years the leader of the class was N. R. Wilson, afterwards professor of mathematics in the University of Manitoba. In the fourth year, in the Physics division of the course, which was chosen by Plaskett, the first place was taken by John L. Hogg, afterwards professor of physics in McMaster University and in the University of Saskatchewan.

After Plaskett's graduation some of us hoped and expected that he would be given a position on the permanent staff in physics but no opening was made for him. In 1902 the contract for a new observatory and its equipment at Ottawa had been awarded, and the Chief Astronomer, W. F. King, was in need of a competent man to give advice on the instruments and to see that they were properly installed. Again Professor W. J. Loudon was the helpful go-between. He was an intimate friend of Dr. King, and recommended Plaskett as the very man for the position. He left the service of the University on June 30, 1903; and his place as Mechanician was taken on the day following by his brother, Thomas S. Plaskett, who held the position until he retired on pension, June 30, 1936. He died December 23, 1939.

THE SATELLITES OF JUPITER

By Seth B. Nicholson

(With Plate XIV)

THE four large satellites of Jupiter were the first objects discovered in the solar system, at least they were the first for which the details of the discovery are known. They were first seen on January 7, 1610, by Galileo with the most powerful telescope in the world, a new one, 2 inches in diameter, which he had just made. In the introduction to his account of their discovery he wrote:

> I have now finished my brief account of the observations which I have thus far made with regard to the Moon, the Fixed Stars, and the Galaxy. There remains the matter which seems to me to deserve to be considered the most important in this work, namely, that I should disclose and publish to the world the occasion of discovering and observing four Planets, never seen from the very beginning of the world up to our own times, their positions, and the observations made during the last two months about their movements and their changes of magnitude; and I summon all astronomers to apply themselves to examine and determine their periodic times, which it has not been permitted me to achieve up to this day, owing to the restriction of my time. I give them warning, however, again, so that they may not approach such an inquiry to no purpose, that they will want a very accurate telescope.

In Figure 1 is reproduced part of a page of Galileo's notebook in which he records his discovery of Jupiter's satellites.

These satellites are now easily observed with almost any small telescope, and they are extremely fascinating objects for the amateur astronomer to study. In observing them and in redetermining their periods and distances from Jupiter he can feel anew the thrills that Galileo must have felt in studying their motions and then being able to predict where each would be on the next night. They always lie near a straight line through the planet, and their motions are comparatively easy to follow. Back and forth they oscillate from one side of Jupiter to the other, now all on one side, now some on one side and some on the other, now one or more hidden behind the planet or lost in its shadow, just as described by Galileo in 1610.

Although named Io, Europa, Ganymede, and Callisto, in order of their distances from the planet, these names are now seldom used,

the numbers I, II, III, and IV being used instead. Their periods of revolution range from 1 day and 18 hours to 16 days and 16 hours, and their distances from Jupiter from 262,000 to 1,169,000 miles. I and II are about the same size as our moon, III and IV about the size of the planet Mercury. When they pass between the sun and Jupiter, they cast small distinct black shadows on the planet's surface. When they are between us and Jupiter, their disks, outlined against the planet, are not nearly so conspicuous as their shadows. This is

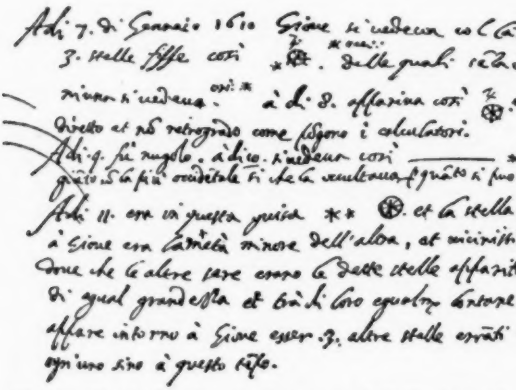


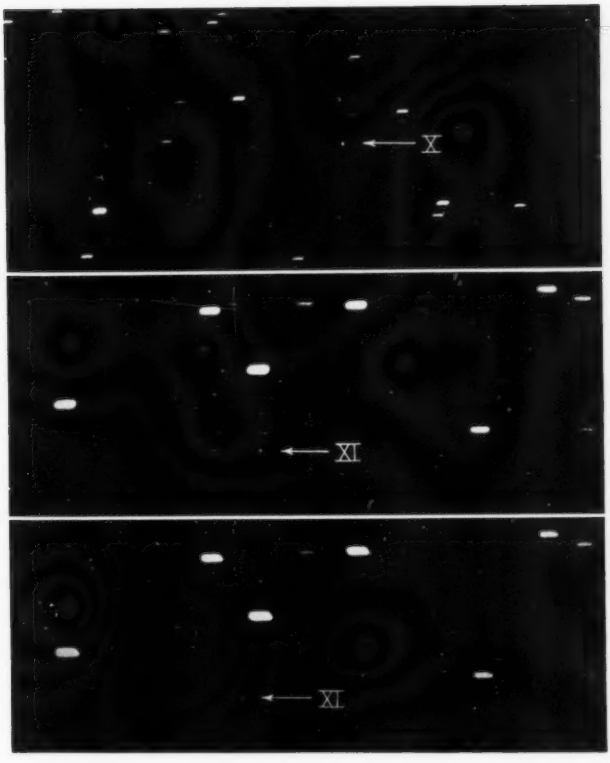
Fig. 1.—Facsimile of part of a page of Galileo's notebook recording the discovery of satellites revolving around Jupiter.

The record is for January 7-11, 1610, and includes four sketches showing the positions of the satellites at the times of observation. These can be recognized in the figure with the aid of a reading lens. On the 7th there are 2 satellites on the "ori:" or east (left in figure) of the planet and 1 on the "occi:" or west side.. On the 8th, 3 are on the west side. On the 9th, 2 are on the east. On the 11th, still 2 on the east but with altered distances and brightness.

because the albedo of the satellites is nearly like that of Jupiter. Satellite I is barely visible when near the center of the planet's disk but is brighter than the planet near the limb. II is brighter than the brightest part of Jupiter's disk. III appears darker than Jupiter near the center of the disk but of about the same brightness as the planet near the limb. Number IV is the darkest of all and when near the center of Jupiter's disk appears quite black, almost like a shadow.

Galileo discovered these satellites before the Copernican theory of the solar system was generally accepted. Many people of his day

PLATE XIV



SATELLITES X AND XI OF JUPITER

The two bottom photographs are the discovery photographs of Satellite XI made by S. B. Nicholson of the Mount Wilson Observatory with the 100-inch reflector, 1938 July 30th. The motion of the satellite can be observed between exposures by comparing it with the stars. The top photograph is one made of Satellite X on the 25th of August of the same year.

Top photograph—J X. 1938 August 25. Exposure 31 min. Length of star trails 10″. Image centered on plate.

Two lower photographs—J XI. Discovery plates, 1938 July 30. Exposure 60 min. Length of star trails 15″. The image of the satellite on the upper reproduction was 26′ from the center of the original plate and 29′ on the lower.

Journal of the Royal Astronomical Society of Canada, 1941

were willing to concede that a planet might revolve around the sun, but did not believe that the moon could circle around the earth while both travelled around the sun. Galileo cited the satellites of Jupiter as visible proof that such a phenomenon was possible. "Here," he said, "our sense of sight presents to us four satellites circling about Jupiter, like the Moon about the Earth, while the whole system travels over a mighty orbit about the Sun in the space of twelve years."

In addition to demonstrating visibly the nature of the solar system, Jupiter's satellites were responsible for the discovery of another very important fact of nature, namely, that time is required for light to travel from one place to another. In 1675, the Danish astronomer Roemer noticed that when Jupiter was far from the earth the eclipses of its satellites occurred relatively later than when it was near the earth. This delay, he explained, was because it took time for light to come from Jupiter to the earth. A determination of the velocity of light by this historic method is quite within the means of the amateur observer, although it requires several months of careful observing. For seventy-four years it was the only known way to determine the velocity of light, but now much more accurate methods have been devised.

No more satellites of Jupiter were discovered until September 9, 1892, almost 300 years after Galileo's time, when Professor Barnard, who had been searching with the 36-inch telescope at the Lick Observatory one night each week for 2 months, detected a faint satellite very close to the planet's surface. Only twelve hours are required for its journey around Jupiter and it is, therefore, visible for only a very few hours each night. This fifth moon of Jupiter has the distinction of being the last satellite in the solar system to be discovered visually; since then all such discoveries have been made with the aid of photography.

In December 1904 a photographic search for faint distant satellites of Jupiter was begun by Perrine with the 36-inch Crossley reflector at the Lick Observatory. On the very first photograph of that search a new satellite was discovered and a month later, in January 1905, still another. The first of these, although about half as bright as Barnard's satellite, is easily visible with the 36-inch tele-

scope, but it is far out from Jupiter and was probably beyond the area searched by Barnard in 1892. Since 1905, four additional satellites

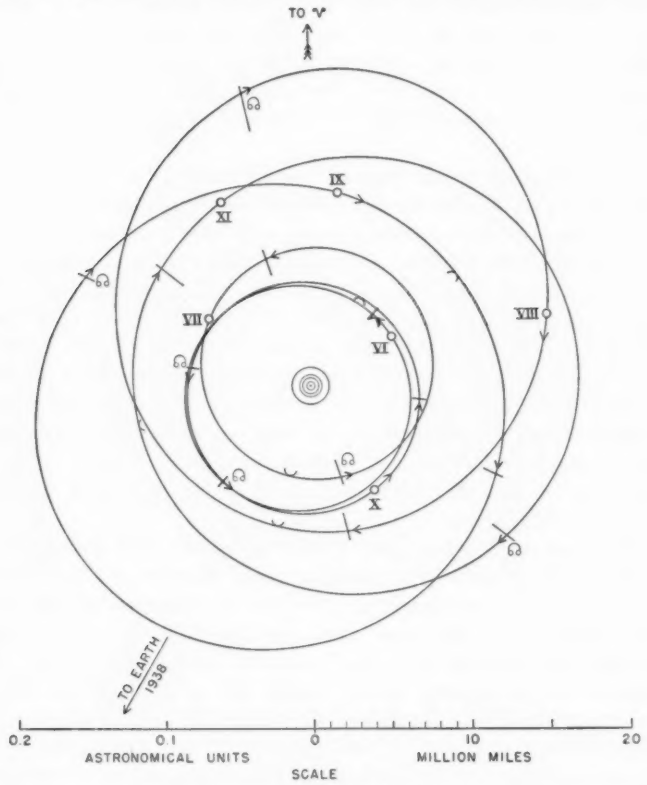


Fig. 2.—Orbits of Jupiter's Satellites

Each orbit is shown as in its own plane. The points where the satellites cross the plane of the earth's orbit are marked by short straight lines cutting the paths. The arrows which show the direction of motion are on the part of the satellite's path that is north of the plane of the earth's path. The point where the path of each satellite is closest to Jupiter is marked by the arc of a small circle concave toward Jupiter. The positions of the satellites are those at the opposition of 1938.

of Jupiter have been discovered photographically, one by Melotte in 1908 at Greenwich, and three by Nicholson, one in 1914 at the Lick Observatory with the same telescope used by Perrine, and the last

two in 1938 at the Mount Wilson Observatory with the 100-inch reflector. (Plate XIV).

When Barnard discovered the fifth satellite of Jupiter several names were suggested for it but none was adopted. Barnard decided not to give it a name but to call it simply the Fifth Satellite or Satellite V. This system of naming has been used ever since, and all the satellites are now known by number, in order of their discovery. Roman numerals are ordinarily used, often preceded by J to identify them with Jupiter. The last one discovered was J XI, the next will be J XII.

The orbits of the satellites, drawn to scale, are shown in Figure 2.

Only the four Galilean satellites are bright enough to be seen with a telescope of moderate size, and J X and J XI have never been seen with any telescope, only photographed. J X is the faintest of the satellites. When nearest to the earth its photographic magnitude is 18.8, no brighter than a candle 3,000 miles away. Perhaps it is not necessary to repeat Galileo's warning that anyone who might wish to see it will need a powerful telescope.

Data about Jupiter's satellites are given in the accompanying table. The magnitudes are for mean opposition, visual for the first six, photographic for the last five (in italics). The diameters of the faint satellites are estimated from their brightness and are probably too large. They may be no more than half the size given in the table.

JUPITER'S SATELLITES

Name	Mean Distance Miles	Sidereal Period Days	Diameter Mag.	Diameter Miles	Discovery	
V	113,000	0.4982	13	150	Barnard	1892
I (Io)	262,000	1.769	5.5	2110	Galileo	1610
II (Europa)	417,000	3.220	5.7	1870	Galileo	1610
III (Ganymede)	664,000	7.155	5.1	3270	Galileo	1610
IV (Callisto)	1,169,000	16.689	6.3	3140	Galileo	1610
VI	7,100,000	250.7	13.7	100	Perrine	1904
VII	7,290,000	259.7	*17*	35	Perrine	1905
X	7,300,000	260.5	*18.8*	15	Nicholson	1938
XI	14,000,000	692	*18.4*	19	Nicholson	1938
VIII	14,600,000	739	*17*	35	Melotte	1908
IX	15,000,000	745	*18.6*	17	Nicholson	1914

The five inner satellites form a family group at an average distance of about half a million miles from the planet, all revolving in the direction of Jupiter's rotation and nearly in the plane of its equator. Satellites VI, VII, and X form another family revolving with direct motion, at a distance of seven million miles, while VIII, IX, and XI, all revolving in a retrograde direction, form a third group, 15 million miles from the planet. The orbits of the six outer satellites have large eccentricities (0.2 to 0.3) and large inclinations (20° to 30°). The orbits of the outer three are so large that Jupiter's attraction is weak and the pull of the sun disturbs their motion around Jupiter so much that their paths do not even approximate closed curves. These three satellites are so far from Jupiter that, as seen from the earth, they are often two degrees or more from the planet and may be as much as three degrees away. When they are photographed with a large reflector, therefore, Jupiter seldom shows on the same photograph.

Whether these outer satellites have been captured by Jupiter and may sometime be lost is a matter of conjecture. The fact that they are in groups may indicate some common origin. On the other hand, satellite orbits may have maxima of stability at those particular distances from the planet so that any satellites at other distances would gradually be pulled into one or the other of these families.

Carnegie Institution of Washington
Mount Wilson Observatory
November 1941

MARS, LA PLANETE ETRANGE . . .

Par ALBÉRIC BOIVIN

INTRODUCTION BY C. A. CHANT

On the occasion of the recent opposition of Mars the Société Astronomique de Québec arranged for an open air meeting to which the public was invited through the radio and the press. It was held in the National Battlefields Park near the Martello Tower which serves as a temporary observatory for the Society. The date chosen was September 29, and although there was great fear for a clear sky at that time of the year, the evening was perfect. "The sight was splendid from the cliff, with the moon reflecting in the St. Lawrence and Mars shining in the south-east sky. Nothing was lacking, not even an auroral arc in the north."

People began to arrive at 7.30 p.m., an hour before the proceedings were planned to start. They were mostly men but included women and children and some English-speaking persons. An address in French was delivered by Mr. Albéric Boivin, a student in the Faculty of Sciences of Laval University and the winner of the Prince of Wales prize for 1939. Somewhat abbreviated, it is printed herewith. Mr. Boivin was able to interest for an hour the 300 persons standing before him in the cool weather. The lecture was illustrated with some 25 lantern slides, the projector and amplifiers being furnished by Mr. Lionel Gallichan. At its close the crowd invaded the Tower to look at the planet through the 4-inch refracting telescope mounted there, and with the assistance of four policemen each visitor was enabled to have a glance through the instrument. There was great enthusiasm. Every one wished to see Mars, not the moon which was an alternative object for observation. This after-part of the meeting lasted until 11.30, as some were anxious to have a view of Jupiter and Saturn.

LE 30 octobre 1939, une émission radiophonique jetait la panique dans l'état du New-Jersey, aux Etats-Unis. Au cours de la soirée, le speaker interrompit soudain un concert pour annoncer la descente des Martiens sur le New-Jersey. Il revint au micro plusieurs fois dans la suite pour décrire les premières horreurs de l'invasion redoutable.

C'était une mystification de grand style. Son auteur, Orson D. Welles, dramaturge américain, avait adapté à la radio, sous forme de nouvelles-éclairs, le célèbre roman de H. G. Wells, "La Guerre des Mondes".

L'effet produit serait sans doute encore plus sensationnel si l'oeuvre d'Orson Welles était diffusée l'un de ces soirs. Aux belles nuits, en effet, une brillante étoile rouge étincelle dans le sud-est. C'est la planète Mars.

L'astre rouge exerce depuis un siècle un mistérieux attrait sur les foules comme sur les chercheurs. "Lorsque par un ciel très "pur, dit le Chanoine Moreux, au milieu du silence de la nuit, le "champ du télescope s'illumine des feux rougeâtres de Mars, "lorsque le disque de la planète, tournant sur lui-même comme la "Terre, amène sous les yeux de l'astronome ébloui ses étranges "configurations: continents ocreux, plaines verdoyantes, calottes "polaires, nul ne peut se défendre d'un sentiment d'ardente "curiosité."

Mars est la planète du système solaire la plus accessible à nos instruments, si l'on excepte la Lune et quelques astéroides comme Hermès et Eros. Aux oppositions favorables, la distance Terre-Mars s'abaisse jusqu'à 5, 6 x 10^7 km., soit 3, 5 x 10^7 milles. L'année martienne vaut 687 de nos jours, et le volume de la planète est 7 fois plus faible que celui de la Terre.

On s'imagine souvent dans le grand public qu'il suffit de braquer un gros télescope sur Mars pour y apercevoir des merveilles. Il n'en est malheureusement pas ainsi dans la réalité. La petitesse de la planète, combinée avec son éloignement, fait que son disque dans le ciel est minuscule. Ce disque a pour diamètre apparent 25 secondes d'arc, au moment de sa plus grande proximité. C'est le diamètre apparent d'un dix sous vu à 500 pieds de distance.

Certes, les grands instruments amplifient beaucoup ce disque, mais en même temps ils exagèrent démesurément l'agitation atmosphérique. Tous les détails fins sont noyés dans une brume impalpable et il faut attendre patiemment les rares instants de calme pour les distinguer avec netteté.

De grandes taches verdâtres, réparties surtout dans l'hémisphère sud, recouvrent les 2/5 de la surface de Mars. Leur aspect, permanent dans l'ensemble, a permis de déterminer avec précision la durée du jour martien: 24 h. 37 m. 22 s., 70. Deux calottes blanches recouvrent les pôles de Mars et leur étendue varie avec les saisons. La planète possède une atmosphère peu dense, où les formations nuageuses sont rares.

Longtemps, nos connaissances de l'aérographie et de la géographie martiennes se bornèrent aux calottes polaires et aux mers. En 1877 cependant, Schiaparelli, qui observait sous le ciel très pur de Milan, aperçut de fines lignes sombres sillonnant les parties

claires de la planète et reliant les mers. A cette époque, Schiaparelli croyait encore que les mers martiennes étaient de véritables étendues d'eau, et aussi appela-t-il canaux les nouvelles formations.

Avec son réseau de lignes sombres tirées au cordeau, Mars devenait le monde le plus étrange et le plus fascinant. Une fièvre enthousiaste s'empara du monde savant et l'étude de Mars connut une vogue énorme.

Les premières années du 20ième siècle furent témoins d'un véritable emballement pour les canaux martiens. A l'Observatoire Lowell en particulier, on en repéra jusqu'à 660. Cependant, l'unanimité n'a jamais été complète parmi les astronomes quant à l'existence des fameux canaux. Plusieurs observateurs très habiles n'ont jamais pu les apercevoir. D'autres, disposant de grands instruments, sont dans le même cas.

Ainsi, M. Antoniadi, qui observe à Meudon avec la grande lunette de 34 pouces, écrit: "Personne n'a jamais vu de véritable canal sur Mars. Il n'existe que des traînées irrégulières et diffuses." déjà, en 1910, G. E. Hale déclarait avoir observé dans le très puissant réflecteur de 60 pouces du Mont Wilson une quantité considérable de détails compliqués, mais, par contre, qu'il n'avais jamais aperçu les lignes droites et les configurations dessinées par Lowell.

Comme Antoniadi, le Chanoine Moreux, observateur habile et dessinateur accompli, n'observe lui aussi que des lignes très diffuses. Pourtant, certains de ses dessins montrent des canaux fins, tel celui qu'il a pris à Bourges, en 1905.

Mais alors, comment expliquer l'apparition des canaux à de nombreux astronomes, si les canaux n'existent pas! Dès 1905, J. Comas Sola a indiqué qu'il s'agissait là d'une illusion d'optique. Des traînées diffuses et irrégulières existent sur l'emplacement des prétendus canaux; l'oeil, incapable de les séparer, les réunit inconsciemment par une ligne continue. La régularité des canaux s'explique encore, car, dépassé une certaine limite de diamètre apparent, tout objet devient une ligne droite ou un point rond.

Une curieuse expérience permet de se rendre compte qu'il en est bien ainsi. Sur un fond noir, on dessine une globe de Mars où seules sont représentées les mers. Puis, à la dactylotype, on recouvre les parties claires de lettres et de chiffres. Si l'on examine

le dessin à une certaine distance, on voit des lignes très fines et très noires reliant entre elles les extrémités des mers.

Mais en sciences, il faut toujours se défier des analogies mécaniques. Rappelons-nous l'expérience de la goutte d'huile de Plateau, qui prétendait reproduire la naissance du monde solaire d'après le système maintenant reconnu insuffisant de Laplace.

Ainsi, bien que l'expérience précédente soit fort suggestive, nombre d'astronomes pensent tout différemment et soutiennent l'existence objective des canaux à la suite de Schiaparelli, Lowell, Slipher, Pickering, Trumpler et Russell.

L'Observatoire Lowell, situé en plein désert d'Arizona, sur un plateau à une altitude de 2,2 km., jouit d'un ciel excessivement limpide. Aussi, M. Lowell, l'astronome millionnaire, son fondateur, a-t-il pu, dans ces conditions éminemment favorables, obtenir de splendides photographies de Mars où de nombreux canaux sont nettement visibles.

M. Slipher, directeur actuel de l'Observatoire Lowell, se basant sur ces photos affirme, en 1921, "l'existance objective sur Mars d'un réseau de marques linéaires sombres, les canaux, et de petits emplacement sombres, les oasis." Enfin, H. N. Russell, pourtant un pur théoricien, affirme lui-aussi, avoir vu quelques-uns des plus gros canaux, en mai 1937, malgré une nuit de visibilité médiocre à Flagstaff.

La lumière est loin d'être faite, on le voit, sur la question des canaux. L'aspect réel de Mars est une véritable énigme. Les canaux, dans l'hypothèse de leur réalité objective, restent très difficile à interpréter. Il n'y a rien d'absolument semblable sur la Terre ou la Lune.

Certes, autour de certains cirques lunaires, comme Tycho, des raies brillantes s'irradient dans toutes les directions, jusqu'à de grandes distances. De même, le sol de certaines plaines lunaires présente parfois des failles rectilignes. Mais les canaux martiens diffèrent de ces formations par leur coloration, leur distribution particulière et surtout par leur périodicité.

Peut-être les canaux sont-ils dus à une compartimentation de l'écorce martienne au moment de sa solidification qui dut être rapide, comme l'a suggéré Moreux.

L'aspect rectiligne et régulier des canaux a donné à beaucoup

de personnes l'impression qu'on était là en présence d'une oeuvre artificielle. Cette hypothèse a été développée brillamment par Lowell en de nombreux ouvrages.

Signalons toutefois que les recherches récentes d'un astronome canadien, le Dr. Millman[1], tendent à démontrer l'absence sur Mars de végétation, du moins du genre de celle que nous connaissons sur notre globe. Le spectroscope permet de distinguer entre le vert dû à la chlorophylle des plantes, et le vert d'un corps chimique, la peinture, par exemple.

Les recherches du savant canadien ont montré que la lumière réfléchie par les mers martiennes est surtout intense dans l'indigo et le violet, tandis qu'elle est faible dans le vert et le jaune, où, au contraire, le spectre de la chlorophylle est particulièrement intense. Faut-il en conclure que les plantes martiennes sont dépourvues de chlorophylle à l'instar de certains cryptogames terrestres?

La vie sur Mars doit certainement présenter bien des différences avec les formes biologiques terrestres.

Ceci nous amène à poser la question brûlante: la vie peut-elle exister ailleurs que sur le Terre?

Tout le Cosmos obéit aux mêmes lois physiques et chimiques et ces loi sont précisément celles de notre physique et de notre chimie terrestres. Ce fait est surabondamment établi par les admirables découvertes de l'Astronomie depuis la Renaissance.

De même, nous ne voyons aucune raison pour que notre Biologie n'ait qu'une valeur purement locale. Pourquoi les lois de la vie à 60,000,000 km. de la Terre diffèreraient-elles des lois auxquelles le phénomène vital obéit manifestement ici-bas? Or, l'apparition et le développement de la vie sur la Terre sont liés, nous le savons, à un ensemble de conditions essentielles dépendant de l'état physique et de la constitution chimique du milieu. La vie, au moins dans ses manifestations supérieures, ne peut se produire et se développer que dans des limites assez étroites de température. Quant à la pression, il semble qu'elle puisse varier dans de plus larges limites. On sait les pressions énormes supportées au fond de nos océans par la faune invraisemblable qui y vit.

[1]"Is there vegetation on Mars?", by Dr. Peter M. Millman, *The Sky*, August 1939, p. 11.

Enfin, le milieu doit offrir en proportion raisonnable, de l'eau, de l'oxygène et du carbone. Si nous sommes sûrs de la réalisation de ces conditions sur un astre, nous pouvons en inférer logiquement la présence de la vie sur cet astre ou du moins sa possibilité.

Or, nous savons que l'eau existe sur Mars. La planète est entourée d'une atmosphère dont la pression diffère, somme toute, pas tellement de la nôtre. Cette atmosphère renferme probablement de l'oxygène à l'état de traces. La planète Mars étant plus éloignée que nous du Soleil, la température à sa surface doit être plus basse qu'ici. Des mesures directes effectuées au Mont Wilson en 1939, indiquent cependant une température plus élevée qu'on ne l'avait cru jusqu'ici. A l'équateur, à midi, la température pourrait atteindre 85° F.

Ainsi, personne ne peut affirmer que la vie soit impossible sur Mars. L'existance de formes inférieures ou adaptées y est possible. Aux époques de rapprochement de la planète, on a installé, le Dr. Todd en particulier, de puissants récepteurs radiophoniques dans le but de se rendre compte si, de la planète rouge, on n'essaierait pas d'entrer en communication avec nous. Jusqu'ici, les résultats ont été négatifs! Nul doute que le réflecteur de 200 pouces, qui entrera bientôt en opération, permettra de savoit définitivement si la vie, au moins végétale, existe encore sur Mars, et si les canaux, dans l'hypothèse de leur objectivité, sont bien l'oeuvre artificielle des Martiens.

Peut-être aussi faudra-t-il attendre pour la réponse à ces passionnantes questions, les premiers vols interplanétaires. L'astronautique ou technique du vol cosmique a passé depuis 25 ans du stage littéraire à celui de la recherche expérimentale. La réalisation des grands vols en dehors de notre planète dépend surtout de la possibilité d'utilisation au moins partielle de l'énergie intra-atomique. Naturellement, Mars sera la première planète après la Lune, à recevoir la visite des explorateurs terrestres.

Le conférencier commenta pour finir quelques aquarelles de Lucien Rudaux, dont il montrait des reproductions sur transparents. C'était des conceptions originales des paysages martiens, scènes désertiques pour la plupart, car, nous disent les astronomes,

"Mars est un monde plus vieilli que le nôtre. Notre voisine

"dans l'espace nous présente l'état intermédiaire entre la Terre et "la Lune. Les phénomènes auxquels nous assistons de très loin, "ne sont que les dernières manifestations d'une vie qui s'éteint. "Lentement, bien lentement, le temps a fait son oeuvre: c'est "l'anesthésie par le froid, celle qui endort les mondes et les achemine "doucement vers la mort". (Moreux.)

ARTICLES DE REVUES ET OUVRAGES CONSULTÈS

La Nature, numéros 2954 (1935), 2956 (1935) et 3053 (1939).
Scientific American, septembre 1937 (Russell).
LOWELL, *Mars and Its Canals* (1906).
PICKERING, *Mars* (1921).
MAURICE FOUCHÉ, *Les Merveilles du Ciel* (1921).
MOREUX, *La vie sur Mars* (1924).
MOREUX, *Les autres mondes sont-ils habités?* (1926).
ANTONIADI, *La planéte Mars* (1930).

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HENRY ALLEN McTAGGART

By E. F. Burton

EARLY on the morning of Wednesday, November 12, 1941, Henry Allen McTaggart, Professor in the Department of Physics, University of Toronto, passed away after a very short illness. About ten days before his death, he had to remain home on account of the loss of his voice which was diagnosed by his doctor as a case of influenza. After a week's absence he returned for a few lectures but suffered a heart attack on his way home from the University. After this he summoned a taxi and visited his doctor, but probably did not reveal all the details of his recent attack. He went to bed but insisted on getting up for his meals; the final seizure came on late in the afternoon of Armistice Day, November 11th.

In the death of Professor McTaggart the Department of Physics and the whole University of Toronto lost one who had served for over thirty years, unselfishly, with meticulous care, the best interests of his students and of his Alma Mater.

Dr. McTaggart was born in Kemptville, Ontario, on October 1, 1876, but while still a boy the family moved to Vancouver, where his father set up in business, which flourished and engaged the attention of the family for many years. McTaggart was one of the first class to enter the first high school opened in Vancouver in 1891. He came to the University of Toronto in October, 1903; he enrolled in University College in the Honour course in Mathematics and Physics from which he graduated in 1907, having specialized in physics in his last year. This particular class might be designated "the class of embryonic professors." Among his class-mates, in alphabetical order, were: Dean S. Beatty, University of Toronto; Chancellor and President Brown of Victoria University; Professor Alfred S. Johns, formerly of the University of West China, now at McMaster University, Hamilton; Professor Lorne Richardson, formerly of the Naval College, Halifax, and the Royal Military College, Kingston, now serving as educational adviser to the Canadian Naval Services; and Professor J. K. Robertson of the Department of Physics, Queen's University, Kingston. Throughout their course and subsequently, McTaggart and Robertson were a modern David and Jonathan.

After obtaining his B.A. in 1907, McTaggart remained as Demonstrator in Physics continuously until 1912, when he went to the Cavendish Laboratory, University of Cambridge, England, to continue, under Sir J. J. Thomson, graduate work and research. While at Cambridge he was attached to Caius College. At the end of this two-year period he returned to the University of Toronto as Lecturer in Physics. Since that time he advanced through the intermediate grades and reached the position of full professor some five years ago. About the same time he was elected a Fellow of the Royal Society of Canada.

The opening of the 1914 World War called for assistance of scientists in many fields, and when the University of Toronto Base Hospital was organized McTaggart offered and was accepted as technical specialist for X-ray work. He proceeded with this unit to Salonika, where the hospital served during anxious times on this front. McTaggart suffered an attack of malaria while at Salonika, from which he never completely recovered.

When Professor J. C. McLennan went to England in 1916 to engage full time in scientific war research he obtained the transfer of McTaggart, who then held the rank of Captain, to serve as the head of the Admiralty Research Laboratory in West Kensington. McTaggart worked faithfully and strenuously in this position until the end of the war and returned to Toronto in 1919.

A few years afterwards he presented himself for the degree of Ph.D. in Physics and received it in 1922. The title of his doctor's thesis was "On the electrification of the boundary between a liquid and a gas." A list of Professor McTaggart's published papers is placed at the end of this article. A glance at the list reveals the trend of McTaggart's own scientific interests. His work was not on what we might call, in the good sense of the term, the notorious subjects of physics research—such as X-rays, radio-activity and smashing the atom, which make from time to time the headlines in our daily papers. His work was rather in the by-paths, subjects of intense theoretical interest, apt at any time to contribute wonderfully to our knowledge of the structure of matter and to throw light on how things really work. He made some excellent investigations into the phenomena taking place at the surfaces of separation of gases, liquids and solids. In all his

research he was rather a lone worker and insisted on doing all the critical work with his own hands.

In the internal economy of the Department of Physics, Professor McTaggart was in complete charge of the elementary light laboratory and advanced geometrical optics. In the graduate school he lectured on hydrodynamics, relativity, the physics of surfaces and optical computing. The outstanding characteristics of his work were preciseness and elegance and in his attitude to his classes he combined friendliness and dignity. His laboratory was a model of neatness and efficiency; no surprise visit would ever discover any trace of disorder.

Two of his former colleagues, now serving in other Canadian universities, sent almost identical comments:

"The world could do well with more gentlemen of his sort."

Department of Physics,
University of Toronto.

PAPERS BY H. A. MCTAGGART

On the Constitution and Properties of Heusler's Alloys. *University of Toronto Studies*, No. 23, 1908.

Note on the Temperature Variations in the Specific Resistance of Heusler's Alloys. (McTaggart and Robertson.) *Trans. Roy. Soc. Can.* III, 2, p. 31 (1908).

The Constitution and Properties of Heusler's Alloys, including a Study of their Microstructure. *Trans. Roy. Soc. Can.*, III, p. 135, Aug. 1909.

Composition of the Vapour and Liquid Phases of the System Methane-Nitrogen. (McTaggart and Edwards.) *Trans. Roy. Soc. Can.*, III, p. 57, 1919.

A Property of Very Small Bubbles of Gas in Water. *Trans. Roy. Soc. Can.*, III, 18, p. 129, 1924.

The Electrification at Liquid-Gas Surfaces. *Phil. Mag.*, Feb. 1914, p. 207.

Electrification at Liquid-Gas Surfaces. *Phil. Mag.*, Sept. 1914, p. 367.

On the Electrification at the Boundary between a Liquid and a Gas. *Phil. Mag.*, Aug. 1922, p. 386.

A Study of Films of Oil inside a Small Bubble of Gas in Water. *Trans. Roy. Soc. Can.*, III, 21, p. 249, 1927.

The Brownian Movement in Surface Films. *Trans. Roy. Soc. Can.*, III, 23, p. 53, 1929.

Thin Films on a Water Surface. (With B. G. Whitmore and R. Richmond.) *Trans. Roy. Soc. Can.*, III, 27, p. 113, 1933.

Some Measurements on the Ellipticity of Light Reflected from Thin Films of Oriented Molecules. *Trans. Roy. Soc. Can.*, III, 31, p. 141, 1937.

Removing the Glare. *Jour. Roy. Ast. Soc. Can.*, vol. 33, p. 213, 1939.

REVIEW OF PUBLICATIONS

Observations of Mars and Its Canals. By Harold B. Webb. Pp. 51; 5½x8½ ins. Published privately, 9251—173rd St., Jamaica, N.Y., U.S.A., 1941. Price, $1.50.

This book succeeds Mr. Webb's 1936 presentation of his own Mars observations from 1926 to 1935 in *Observations of the Planet Mars* by giving an extensive series of observations by himself and eleven other American amateurs mainly during the 1937 and 1939 apparitions of the planet. The book should greatly interest those amateurs who have made notes on Mars in the past or who contemplate future observation, even with modest equipment, for the book demonstrates what can be seen with ordinary amateur's instruments: 5-in. to 12-in. refractors and 5½-in. to 12-in. reflectors. This feature is almost unique, for the amateur has nearly always had to examine pictures of what can be seen with *large* telescopes! Those who have made systematic studies will appreciate the availability of so much reference material.

Pages are divided about equally between text and illustrations, the latter consisting principally of four maps of Mars for the years 1919-20, 1924, 1937, and 1939, and 187 disk drawings made at the observers' telescopes. The disk drawings are ink-recopies of the originals but appear to be carefully and accurately finished and are quite satisfactory. With each is given the observer, his telescope and magnification, and the date and time. It is regretted that some physical data, especially at least central meridian, are not given also. While comparisons among the sketches are therefore not facilitated, the series again illustrates the unfortunate differences in interpretation of detail and style of sketching which exist among any groups of visual observers. The two pages of photographs of the planet by L. J. Wilson will show what may be done by the amateur in that direction.

The text will be of interest to the beginning Mars worker, though it seems to be rather qualitative and too brief to be quite adequate for the subjects covered. There are several slips in spelling and grammar, and a couple of minor errors in the data for the drawings were detected. However, these inaccuracies do

not appreciably detract from the general interest or usefulness of the book. The price does not seem unreasonable for so specialized a subject.

HUGH M. JOHNSON.

Sky and Telescope

Amateur astronomers throughout the English-speaking world, and particularly those of the United States, will welcome the first number, November, 1941, of a new monthly magazine, *Sky and Telescope*. While our own JOURNAL and the Royal Astronomical Society of Canada, which sponsors it, have long had a Dominion-wide organization, the field of popular astronomical publications in the United States has been shared by various magazines sponsored by individual astronomical clubs, societies and planetaria. These publications have ranged from brief mimeographed pamphlets to elaborately illustrated magazines of very high quality.

Recently the trend has been towards co-ordination, both of individual clubs, and of publications. Gradually the *Telescope*, founded ten years ago by Professor Stetson, at the Perkins Observatory, and later published by the Bond Astronomical Club, at Harvard, or *The Sky*, sponsored by the Hayden Planetarium of New York, were adopted as the official publications of many of the societies of the United States. The resulting increase in circulation, and wise management of these publications allowed them to be still further improved.

Now these two magazines have combined as the *Sky and Telescope*, with editorial offices at the Harvard College Observatory. The November and December numbers are both at hand, and are of very fine quality. Mr. Charles Federer, formerly editor of *The Sky*, and now editor of the new publication, is to be congratulated on the new wide field that the magazine should enjoy.

More advanced amateur astronomers and professional astronomers will, of course, continue to find popular and more technical articles in the two distinguished American publications—*Popular Astronomy*, founded in 1893, and *Publications* of the Astronomical Society of the Pacific, founded in 1889.

F. S. H.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

Grant to the Quebec Astronomical Society

Mr. Paul H. Nadeau, the secretary of this society, reports the receipt from the Provincial Government of a grant of $100, to assist in the construction of a dome for the society's observatory. This Journal congratulates the society on this official recognition of its worthy efforts to extend the cultivation of astronomy.

Death of G. Parry Jenkins

On December 7, at the home of his daughter Mrs. Arthur Scoones, Mimico near Toronto, Ont., Griffith Parry Jenkins died in his 82nd year. A son Archie, of Toronto, also survives.

Mr. Jenkins was one of the leading members of the Hamilton Centre of the R.A.S.C. when it was organized in 1909. He had been a member of the Astronomical Society of Wales and was acquainted with a number of English amateur astronomers. In this Journal, vol. 5, p. 59, 1911, appears a paper by Mr. Jenkins entitled "A plea for the reflecting telescope" in which he gives many interesting incidents of his association with T. W. Webb, George H. With and others. In 1938 Mr. Jenkins brought to the David Dunlap Observatory a copy of the volume "Speculum Hartwellianum," by Admiral W. H. Smyth (London, 1860). On page 2 of the cover is the inscription: "Presented to the Reverend Thomas W. Webb, A.M., F.R.A.S., with the respects of Admiral Smyth and Dr. Lee, Hartwell, 27 February, 1860"; and on the adjoining fly-leaf is:

> This rare volume, printed for private circulation, was acquired by me fifty years ago at a sale of the books belonging to my old friend, the Rev. T. W. Webb, when I then resided in the city of Hereford. I now donate "Speculum Hartwellianum" to the library of the David Dunlap Observatory, Richmond Hill, Ont., where I know it will be treasured by another old friend of long ago—Prof. C. A. Chant.
>
> (Signed) G. Parry Jenkins
>
> Toronto, September 17, 1938.

Founding of the Yerkes Observatory

The Fiftieth Anniversary of the founding of the University of Chicago was celebrated in September of this year. Regarding the Yerkes Observatory, Dr. Otto Struve, its present director, in *Science* of October 10, says:

Although the Yerkes Observatory was officially dedicated in October 1897 (at this occasion a conference of astronomers was held at Williams Bay, which organized the American Astronomical Society), the department of astronomy of the University of Chicago also marks its fiftieth anniversary. Exactly fifty years ago Professor George E. Hale undertook at the Kenwood Observatory in Chicago his epoch-making photographic observations of solar prominences and of flocculi on the disc of the sun. In a letter which Mr. Hale wrote in 1923, on the occasion of the twenty-fifth anniversary of the Yerkes Observatory, he described this period in the following words: ". . . . I must find a way to photograph the solar prominences without an eclipse. When this had been done at Kenwood in the autumn and winter of 1891-92, and when it appeared that a promising opportunity for progress lay in the study of the flocculi which I had found and photographed on the face of the sun, I determined that I must have a larger telescope—one that would carry powerful spectroscopes and spectroheliographs and would give a large image of the sun suitable for the study of the structure of spots, flocculi and prominences."

Apparently the idea of building a large telescope for the University of Chicago came early in 1892. Hale had been corresponding with John A. Brashear, the famous lens maker of Pittsburgh, about a 12-inch photographic objective to serve as a twin for the visual lens which he had obtained for the Kenwood Observatory. The glass had been ordered in 1891 from Mantois in France, but there were various delays in casting the disc, and on March 1, 1892, Brashear suggested that "our American friends are casting a 20-inch flat and if we carry out our wishes we will exhibit a 20-inch objective made of American glass at Chicago." Evidently the Columbian Exposition of 1893 served as a powerful stimulus to telescope makers, as well as astronomers! Brashear was seriously ill in the spring of 1892 and during

the following summer he undertook a trip to Europe. On July 5 he wrote to Hale saying that the Saint Gobain people had quoted a price of $1 per kilo on a 30-inch disc. "Hence a 30-inch disc, 4 inches thick will cost about $135. . . ." In September 1892 Mr. Charles T. Yerkes agreed to finance the construction of a large telescope, and two 40-inch discs, originally made by Mantois for the University of Southern California, were purchased when it was learned that this institution would not require them. The mechanical parts of the telescope were completed by Warner and Swasey of Cleveland in 1893. The great lens was tested in the optical shops of the makers—Alvan Clark and Company of Cambridgeport, Massachusetts—in October 1895, and the first astronomical observations were made by Mr. Hale and his associates in 1897.

A new method of avoiding the wasteful loss of light through reflection from the surfaces of the glass in systems of lenses, plate-glass windows and other objects is described by *Science Service* as follows:

THE REMOVAL OF REFLECTIONS FROM THE SURFACE OF LENSES

A new chemical prcoess that can wipe troublesome reflections off the glass of show windows, pictures, camera screens and lenses and airplane instruments has come out of current RCA television research and a clue that was dropped in 1900 by Lord Rayleigh, the English physicist.

The new method, developed by Dr. F. H. Nicoll, of the RCA Laboratories, is to expose the glass surface to hydrofluoric acid vapour. This vapour etches away a small amount of surface and leaves a thin, transparent film of calcium fluoride about one quarter of a light wave-length in thickness.

This almost invisible film not only abolishes most of the reflection from the surface, but the light that otherwise would be lost in reflection is saved and transmitted through the glass. Thus the very thin film is of great usefulness in speeding up lenses used in photography and television. Happily, tests show that the film formed by the hydrofluoric etching is very tough, withstanding washing with such things as water and alcohol. It can be heated safely to high

temperatures. It is purple in colour, showing that yellow and green, to which the human eye is quite sensitive, are not reflected.

This discovery was made during experiments to improve contrast of television cathode-ray tubes. It promises to allow television to be viewed in rooms that are not quite so dark as heretofore required. Television images are light-painted on the glass protector plate and then reflected from a mirror. In each case reflection cuts efficiency unless the new film is used.

Very thin coatings have been successfully used in the last few years to suppress reflections from glass surfaces as a result of researches by Drs. John Strong, Katherine Blodgett and C. H. Cartwright. In these earlier processes coatings of various sorts have been added to the glass, while Dr. Nicoll's method etches the glass to produce a film. Commercial applications of the new process are being developed.

Lord Rayleigh more than forty years ago jotted down in his records that hydrofluoric acid diluted in 200 parts of water took off a layer of glass each hour amounting to about a quarter wave-length of light. This was the clue used by Dr. Nicoll in developing his new process of making glass more transparent.—*Science Service.*

C. A. C.

MEETINGS OF THE SOCIETY

October 8, 1941.—The Winnipeg Centre held its first meeting of the season in Rupert's Land Ladies' College.

The president, Mr. L. W. Koser, presented to each member a very excellent star map for Lat. 50° which he had drafted. The principal stars were listed with their declinations and right ascensions. Mr. Koser explained how to mount his star map to make a workable planosphere.

Mr. Koser also demonstrated the use of a "pocket observatory" which he had acquired from Newark.

Moving pictures courteously loaned by the Canadian Pacific Railway were shown.

A further pleasant hour was spent when tea was served.

November 12, 1941.—The regular meeting of the Winnipeg Centre was held in Theatre "F", University Building. The president, Mr. L. W. Koser, was in the chair.

The death of Dr. J. S. Plaskett called forth many expressions of regret and sorrow. A motion was passed that a letter of condolence be sent to Mrs. Plaskett.

The address of the evening was given by Squadron Leader A. H. Gillson, who is chief instructor of the Rivers R.C.A.F. Navigation School.

The speaker began by referring to animals and birds which seem to possess direction-finding ability which is lacking in human beings. Man first used roads as a means of navigation and maps were and still are of utmost importance. In still air it is necessary for an air navigator to measure the angle from north to the desired destination and to travel the required distance.

The difficulty lies in the wind. This is partly overcome by receiving careful forecasts of wind velocities and directions from meteorological stations. After making simple calculations it is not difficult to set a course on which the navigator will arrive at the desired destination in spite of this wind drift. A real difficulty arises when the wind varies in velocity. The navigator has then to find the wind's speed. This is done by changing course and measuring the drift angle for each course. Simple geometry gives the speed.

Position may be determined by radio but this method is not secret and is affected by the aurora. Owing to this cause, Canadian pilots, in error, landed in the U.S.A. last year. Radio beams, too, are said to have been bent by human control.

The best method of finding position is by astronomical navigation. A bubble spirit-level gives the horizon line and a sextant will give the average of eighteen altitudes of a chosen star. Then a second star's altitude is taken. Simple calculation for eight to ten minutes with the air almanac will give to within about two miles the position of the observer.

Many interesting questions were asked.

In peace time Squadron Leader A. H. Gillson is a professor at McGill University.

Mr. G. P. Morse moved a vote of thanks to the speaker. This was heartily approved by everyone at the meeting.

SUMMER EVENINGS WITH THE STARS—VICTORIA, 1941

By K. O. Wright

DURING the summer of 1932 a small group of amateur astronomers, members of the Victoria Centre of the R.A.S.C., met weekly at Mr. H. Boyd Brydon's Oak Bay Observatory to discuss the most interesting features of astronomy and to discover for themselves the wonders of the heavens which were to be seen through his four-inch refractor. Their aim has been stated: "to stimulate interest and knowledge of practical astronomy, to afford an opportunity for constellation study and for experience in observational work". Ten meetings were held and the celestial sphere, the constellations, the solar system and the naked-eye stars were studied.

Thus was inaugurated that feature of the Victoria Centre which has grown into the annual series of "Summer Evenings with the Stars". As the course developed from year to year many changes were made. The lectures were designed for pre-members as well as members of the Society; a number of telescopes, most of them made by members of the Society, replaced the single refractor; the meeting-place was changed from Oak Bay to the heights of Victoria College; and, more important, the gatherings grew in number and in interest until the large lecture room in the college became filled and the telescopes were often in use long after the meetings broke up. But the primary object of the series remained the same: to offer the interested beginner an opportunity to learn about the solar system and the starry heavens in talks specially designed to interest him and to give first-hand telescopic views of the grand celestial objects.

The 1941 Summer Course was held on the six Monday evenings from July 21 to August 25 and, in spite of the late starting hour necessitated by the introduction of daylight-saving time, the attendance at the beginning was about seventy-five and, notwithstanding rainy weather, held up to over forty on each of the evenings. Though many persons who attended the lectures were already members of the Society, a great many who had no previous knowledge of astronomy appeared. Of the latter, twenty paid their fee of one dollar which, in addition to the lectures, provided them with star maps and the booklet "Seeing Stars" to help in their home studies of the constellations and the motions of the stars.

At each meeting the lecture was preceded by a short study of individual

summer constellations and each member was provided with a map on which he was encouraged to mark not only the brightness but also the colour of each star in the group. The lectures were couched in as non-technical language as possible and were liberally illustrated with slides and diagrams. After the half-hour talk the meeting adjourned, on clear evenings, to the campus grounds where the members divided into groups to study the constellations of the evening and to observe, through the three or more telescopes which had been set up, the moon, the double cluster in Perseus, the Andromeda nebula or the many double stars available.

A few words concerning each of the lectures will show the type of study.

On July 21 Dr. C. S. Beals spoke on "How to Find the Stars". Most people know that there are winter and summer constellations but what they are and the details of how they change are not understood. Dr. Beals explained the motions due to the rotation of the earth and the revolution of the earth about the sun so clearly that all who heard him should have no difficulty henceforth.

On July 28, Mr. W. H. Stilwell gave an illustrated lecture on the physical features of the sun and moon in which he stressed the prominences and sunspots of the sun and the craters of the moon in their many forms.

On August 11 the Centre was fortunate in securing the services of Prof. C. G. Patton of the College of the Pacific, Stockton, Calif., for a talk on "The Solar Family". As Professor Patton, who was spending a few weeks at the Dominion Astrophysical Observatory, teaches a course in astronomy at his college, the audience were treated to an excellent series of historical notes and facts concerning the members of the solar system.

On August 18 Mr. W. R. Hobday, the director of the telescope-making section of the Centre, discussed "How to Make a Telescope". In contrast to many lecturers who stress how easy it is to make a telescope, Mr. Hobday pointed out that it is not all play and no work. There are many difficulties to be overcome before the mirror is figured to an exact parabola and the mounting is set up in its final form; but, when the many hours of labour are completed, a six-inch reflecting telescope is a scientific instrument worthy of the finest care and capable of observations of the greatest importance in astronomy, especially in the field of variable stars.

On August 25 Mr. Robert Peters spoke on "The Splendour of the Heavens", atopic which is all-embracing to the enthusiastic owner of a telescope. After mentioning the many objects visible through the telescope, the lecturer showed how it had first been used by Sir William Herschel to determine the structure of our own galaxy. This structure has been amply confirmed in the past few years, and with this modern knowledge, especially that determined from observations made at Victoria, the layman now knows far more about the universe than did the professional astronomer fifty years ago.

The special feature of the summer course is always the annual visit to the Dominion Astrophysical Observatory on the special invitation of the director,

Dr. J. A. Pearce. The 1941 visit on August 4 lived up to, and indeed far exceeded, the expectations based upon the experience of past years. For many years the night of the Observatory trip has been fine and clear and the objects shown through the telescope have been excellently visible. This year was no exception. After welcoming the Society, Dr. Pearce gave an illustrated half-hour address on the founding of the Observatory. He showed photographs of the construction of the road, the dome and the erection of the 72-inch telescope. Of particular interest was a photograph of the first visit of the Victoria Centre to the Observatory twenty-five years ago. This was followed by views of a cluster of class B stars in Cygnus which are some four thousand light-years distant, the magnificent cluster in Hercules and finally the beautiful ring nebula in Lyra. In the meantime two smaller telescopes were mounted outside the Observatory and many members were given their first view of the moon through a telescope. The evening was "touched off" with a feast of coffee and doughnuts which was presented to the eighty members of the Society and summer course by the Victoria Centre.

In her report to the Council concerning the activities during the summer, Miss Mira Oliphant, the secretary of the summer course, stressed the interest shown by so many members in the constellation study as well as in the lectures and the telescopic views. The council felt that though no monetary profit was derived from the course, the 1941 Summer Evenings with the Stars had amply repaid their efforts in the renewed interest and appreciation of astronomy and in the new members added to the strength of the Centre.

INDEX TO VOLUME XXXV, 1941

INDEX TO VOLUME XXXV, 1941

A

Absorption Lines of Molecular Origin, The Interstellar, *P. Swings*, 71.
Amateurs and Handbooks, *Walter Scott Houston*, 289.
American Association of Variable Star Observers—Thirtieth Annual Spring Meeting, *D. W. Rosebrugh*, 312; Thirtieth Annual Meeting, *D. W. Rosebrugh*, 374.
Angus, W. Kenneth, An Early Reference to an Astronomical Event Comes to Light, 271.
Apparition of Jupiter, The 1939-40, *Walter H. Haas and Hugh M. Johnson*, 53.
Apparition of Mars, The 1939-40, *Hugh M. Johnson and Walter H. Haas*, 185.
Astrology, What to do about, 371.
Astronomer, The Experiences of an, 41.
Astronomer's Appeal, A Greek, 136.
Astronomical Graph Sheets, *J. W. Campbell*, 353.
Astronomical Society, Another, 42.
Astronomical Society, The Quebec, 433.
"Astronomy" (poem, John Gower), 397.
Astronomy and the War, British, 42.
Astronomy in Canada, Recollections of, *C. A. Chant*, 97.
Astronomy, The Role of Mathematics in, *Alfred T. DeLury*, 281.
Aurorae, The Observing of, *Ruth J. Northcott*, 173.
Auroral Display and Geomagnetic Storm of September 18-19, 1941, *A. G. McNish*, 368.
Auroral Display, Great, 358.

B

Beals, C. S., A Bibliography of the Published Papers of J. S. Plaskett (with R. M. Petrie and K. O. Wright) 408; John Stanley Plaskett, 401.
Beza's Verses on Tycho's Nova, *Thomas L. MacDonald*, 366.
Bible Times, Time in, *Charles Francis Potter*, 163.
Boivin, Albéric, Mars, la Planète étrange, 421.
British Astronomy and the War, 42.
Brown, Ernest William, 1866-1938 (obituary) 43.
Brydon, H. Boyd, Compass Directions in the Telescope, 286; The 1940 Transit of Mercury (with R. M. Petrie) 6; Two Useful Telescope Accessories, 307; Visual Photometry of Variable Stars, 20, 153, 249.
Buchanan, Dr. Daniel, 231.
Bunker, Andrew F., 279.
Burton, E. F., Henry Allen McTaggart, 428.

C

Calendar, A New, 315.
Calendar Reform, *C. E. White*, 343.
Calendars in Egypt, Four, 231.
Calendars, Perpetual and Mental, *C. E. White*, 233.
Calendars, Perpetual Ecclesiastical, *C. E. White*, 241.
Campbell, J. W., Astronomical Graph Sheets, 353.
Cannon, John Beattie, M.A., 1879-1940 (obituary) *T. H. Parker*, 15.
Catalogue of Fireballs Observed in the U.S.S.R., First, 39.
Cepheid Problem, A Tidal Attack on the, *William A. Luby*, 293.
Chant, C. A., J. S. Plaskett at the University of Toronto, 412; James Weir of McGill University, 203; The Moon and the Weather, 227; Recollections of Astronomy in Canada, 97; Sir Frederic Stupart, 137 (see also Notes and Queries and Reviews).
Chant Medal, 89, 359.
Charting the Planetary Phenomena, *Sylvan Harris*, 169.
Collins, J. R. (see Notes and Queries).
Combs, Robert Henley (obituary) *E. J. A. Kennedy*, 225.
Comet Cunningham, 1940c, *Ruth J. Northcott*, 49.

Comet, Morehouse and his, 274.
Compass Directions in the Telescope, *H. Boyd Brydon*, 286.
Cyrene: Birthplace of Eratosthenes, 276-196 B.C., 177.

D

David Dunlap Observatory Staff, The War and the, 86.
DeLury, Alfred T., The Role of Mathematics in Astronomy, 281.
Depression of Lunar Craters, The, *R. A. McIntosh*, 361.
Doctors and Doctors! 177.
Dominion Astrophysical Observatory, A Recalibration of the Standard Lamps of the, *Andrew McKellar and R. M. Petrie*, 337.
Dominion Astrophysical Observatory, Staff of the, 86.

E

Early Reference to an Astronomical Event Comes to Light, An, *W. Kenneth Angus*, 271.
Ecclesiastical Calendars, Perpetual, *C. E. White*, 241.
Eratosthenes, 276-196 B.C., Cyrene: Birthplace of, 177.

F

Fireball of October 22, 1941: Information Wanted, 400.
Fireballs Observed in the U.S.S.R., First Catalogue of, 39.
Four Calendars in Egypt, 231.

G

Garneau, DeLisle, Mars in 1939 as seen through a Four-inch Telescope, 81.
Geomagnetic Storm of September 18-19, 1941, Auroral Display and, *A. G. McNish*, 368.
Grinding Machine, A Hindle Type, *Cyril G. Wates*, 33.

H

Haas, Walter H., The 1939-40 Apparition of Jupiter (with Hugh M. Johnson) 53; The 1939-40 Apparition of Mars (with Hugh M. Johnson) 185.
Handbooks, Amateurs and, *Walter Scott Houston*, 289.
Harris, Sylvan, Charting the Planetary Phenomena, 169.
Henroteau, F. C.—The Experiences of an Astronomer, 41.
Her Majesty's Magnetical and Meteorological Observatory, Toronto, *A. D. Thiessen*, 141, 205.
Hindle Type Grinding Machine, A, *Cyril G. Wates*, 33.
Hodgson, Ernest A., The Interior of the Earth viewed in its Relation to Earthquake Causes: the Viewpoint of Seismology, 321.
Hogg, F. S. (see Notes and Queries and Reviews).
Hogg, Helen S. (see Reviews).
Houston, Walter Scott, Amateurs and Handbooks, 289.

I

Improved Telescope Spider Design, *C. H. Werenskiold*, 268.
Interior of the Earth viewed in its Relation to Earthquake Causes: the Viewpoint of Seismology, *Ernest A. Hodgson*, 321.
Interstellar Absorption Lines of Molecular Origin, The, *P. Swings*, 71.

J

Jenkins, G. Parry (obituary), 433.
Johnson, Hugh M., The 1939-40 Apparition of Jupiter (with Walter H. Haas), 53; The 1939-40 Apparition of Mars (with Walter H. Haas) 185; North Temperate Belt, Markings on Jupiter in 1940-41, 330; (see also Reviews).
Jupiter in 1940-41, North Temperate Belt, Markings on, *Hugh M. Johnson*, 330.
Jupiter, The 1939-40 Apparition of, *Walter H. Haas and Hugh M. Johnson*, 53.
Jupiter, The Satellites of, *Seth B. Nicholson*, 415.

K

Kennedy, E. J. A., Robert Henley Combs, 225.

Lectures before the Society:
TORONTO CENTRE — The Schmidt Camera, *R. K. Young*, 45; The Question of Life on Other Worlds, *P. M. Millman*, 46; Mirror Making for the Amateur, *S. C. Brown*, 87; Recent News about Meteors, *P. M. Millman*, 87; Thunder and Lightning, *J. R. Gibbs*, 88; A Geologist looks at Meteorites, *G. H. Reavely*, 130; Experiments with Short Radio Waves, *A. Pitt*, 131; Electron Microscope, *W. A. Ladd*, 182; Stellar Classifications, *J. R. Collins*, 183; Amundsen's Conquest of the South Pole, *J. R. Gibbs*, 183; Binary and Multiple Stars, *Tracy D. Waring*, 183; The Borderlands of Physics and Astronomy, *J. R. Collins*, 183; Why Does an Observatory Need a Machinist? *Gerald F. Longworth*, 184; The Role of Mathematics in Astronomical Discovery, *A. T. DeLury*, 184; The Way of the Moon, *H. R. Kingston*, 398; Explorations in Clusters and Nebulae: Early References and Catalogues, *Helen S. Hogg*, 399.
VANCOUVER CENTRE — The Gyro-Compass, *Angus Paterson*, 132; Recent Advances in Our Knowledge of Interstellar Material, *Andrew McKellar*, 133; The Sky at 6 O'Clock Tonight, *A. M. Crooker*, 134; Demonstration of teaching apparatus, *H. Hayward*, 134.
VICTORIA CENTRE — Sunlight, *H. Boyd Brydon*, 47; Interstellar Space, *Andrew McKellar*, 47; The Romance of the Stars, *Diana Watts*, 48; The Planet Saturn, *Gordon Shaw*, 280; Exceptions to the Rule, *Walter Gage*, 318; A Master Astronomer, *Robert Peters*, 319; The Structure and Dimensions of Our Universe, *R. M. Petrie*, 319; How Hot Are the Stars? *K. O. Wright*, 320.
WINNIPEG CENTRE — Colour and Architecture, *M. S. Osborne*, 45; Mars, Up to Date, *L. J. Crocker*, 134; Comets, *L. A. H. Warren*, 180; Cosmic Rays, *W. A. Anderson*, 181; Demonstration of his latest planetarium, *V. C. Jones*, 181; Astronomical Observation from the Standpoint of the Amateur, *R. S. Evans*, 232; A Short History of Meteorology, *L. J. Crocker*, 232; Instruments in use at Air Field Weather Stations, *W. P. Johnson*, 232; Cause of Westerly Winds, *H. E. Riter*, 232; Transmission of Energy, *T. W. Morton*, 232; Aerial Navigation, *Sq. Ld. A. H. Gillson*, 437.
Lenses, Removal of Reflections from the Surface of, 435.
Leonard, Dr. Frederick C., 231.
Luby, William A., A Tidal Attack on the Cepheid Problem, 293.
Lunar Craters, The Depression of, *R. A. McIntosh*, 361.

M

MacDonald, Thomas L., Beza's Verses on Tycho's Nova, 366.
McIntosh, R. A., The Depression of Lunar Craters, 361.
McKellar, Andrew A., A Recalibration of the Standard Lamps of the Dominion Astrophysical Observatory (with R. M. Petrie), 337.
McNish, A. G., Auroral Display and Geomagnetic Storm of September 18-19, 1941, 368.
McTaggart, Henry Allen (obituary), *E. F. Burton*, 428.
Magnetical and Meteorological Observatory, Toronto, Her Majesty's, *A. D. Thiessen*, 141, 205.
Mars in 1939 as seen through a Four-inch Telescope, *DeLisle Garneau*, 81.
Mars, la Planète étrange, *Albéric Boivin*, 421.
Mars, The 1939-40 Apparition of, *Hugh M. Johnson and Walter H. Haas*, 185.
Mathematics in Astronomy, The Role of, *Alfred T. DeLury*, 281.
Mathematics in King Charles II's Time, 230.
Maybee, J. Edward, 1866-1941 (obituary) 356.
Mental Calendars, Perpetual and, *C. E. White*, 233.
Mercury, 1940, November 11, Transit of, 42; *H. Boyd Brydon and R.*

M. Petrie, 6; Victoria Observations, *K. O. Wright,* 1.
Meteor News, 39, 84.
Meteorite, A New Iron, 231.
Meteors Published in the U.S.S.R., A New Book on, 84.
Millman, Peter M. (see Meteor News).
Moon and the Weather, The, *C. A. Chant,* 227, 278.
Morehouse and his Comet, 274.
Moseley, Edwin Lincoln, Sun-spots and Tree Rings, 376.
Mount Wilson Observatory, Report for 1940, 229.

N

Nicholson, Seth B., The Satellites of Jupiter, 415.
Noise and Quiet, 317.
North Temperate Belt, Markings on Jupiter in 1940-41, *Hugh M. Johnson,* 330.
Northcott, Ruth J., Comet Cunningham, 1940c, 49; The Observing of Aurorae, 173 (see also Notes and Queries).
Notes and Queries, 41, 86, 128, 177, 229, 274, 315, 356, 396, 433.
Nova, Beza's Verses on Tycho's, *Thomas L. MacDonald,* 366.

O

Obituaries: Bown, E. W., 43; Cannon, J. B., 15; Combs, R. H., 225; Jenkins, G. Parry, 433; McTaggart, H. A., 428; Maybee, J. E., 356; Plaskett, J. S., 358, 401; Stupart, Sir Frederic, 137; Weir, James, 203.
Observing of Aurorae, The, *Ruth J. Northcott,* 173.

P

Parker, T. H., John Beattie Cannon, M.A., 1879-1940, 15.
Patterson, F. Shirley, 279.
Patterson, John, 278.
Pearce, J. A. (see Notes and Queries).
Perpetual and Mental Calendars, *C. E. White,* 233.
Perpetual Ecclesiastical Calendars, *C. E. White,* 241.
Petrie, R. M., A Bibliography of the Published Papers of J. S. Plaskett (with C. S. Beals and K. O. Wright) 408; A Recalibration of the Standard Lamps of the Dominion Astrophysical Observatory (with Andrew McKellar) 337; The 1940 Transit of Mercury (with H. Boyd Brydon) 6.
S. Beals, 401; J. S. Plaskett at the
Photometry of Variable Stars, Visual, *H. Boyd Brydon,* 20, 153, 249.
Planetary Phenomena, Charting the, *Sylvan Harris,* 169.
Plaskett, John S., (obituary) 358, *C. S. Beals,* 401; J. S. Plaskett at the University of Toronto, *C. A. Chant,* 412; A Bibliography of the Published Papers of J. S. Plaskett, *C. S. Beals, R. M. Petrie and K. O. Wright,* 408.

Q

Quebec Astronomical Society, The, 433.

R

Recalibration of the Standard Lamps of the Dominion Astrophysical Observatory, A, *Andrew McKellar and R. M. Petrie,* 337.
Reflections from the Surface of Lenses, Removal of, 435.
Remarkable Observations, to say the Least, 178.
Removal of Reflections from the Surface of Lenses, 435.
Research Physicist's View on Education, A, 275.
Reviews of Publications:
Barlow's Tables . . .; 4th ed. rev. and enl. by L. J. Comrie, *C.A.C.,* 314.
Bok, Bart J. and Priscilla F. Bok, The Milky Way, *H.B.S.H.,* 394.
The Fundamental Properties of the Galactic System (New York Academy of Sciences, Annals, v. 42) *R.K.Y.,* 395.
Merrill Paul W., Spectra of Long-Period Variable Stars, *F.S.H.,* 85.
Sky and Telescope, *F.S.H.,* 432.
Watson, Fletcher G., Between the Planets, *C.A.C.,* 393.

Webb, Harold B., Observations of Mars and its Canals, *Hugh M. Johnson*, 431.
Wintner, Aurel, The Analytical Foundations of Celestial Mechanics, *A. F. Stevenson*, 273.
Role of Mathematics in Astronomy, The, *Alfred T. DeLury*, 281.
Rosebrugh, D. W., American Association of Variable Star Observers —Thirtieth Annual Spring Meeting, 312; Thirtieth Annual Meeting, 374.
Royal Astronomical Society of Canada, Annual At-Home, 89; Annual Meeting, 105; Chant Medal, 89, 359; Elected Members-at-Large, 127.

S

Satellites of Jupiter, The, *Seth B. Nicholson*, 415.
Science and Faith, 396.
Sirius, Sparkling, 128.
Stars, Visual Photometry of Variable, *H. Boyd Brydon*, 20, 153, 249.
Stevenson, A. F., (see Reviews).
Stones from Heaven—by Plutarch (about A.D. 46-120) 178.
Stupart, Sir Frederic, (obituary) *C. A. Chant*, 137.
Summer Evenings with the Stars—Victoria, 1941, *K. O. Wright*, 438.
Sunrise from an Aeroplane, 228.
Sun-spot Maximum, The Last, 129.
Sun-spots and Tree Rings, *Edwin Lincoln Moseley*, 376.
Swings, P., The Interstellar Absorption Lines of Molecular Origin, 71.

T

Telescope Accessories, Two Useful, *H. Boyd Brydon*, 307.
Telescope, Compass Directions in the, *H. Boyd Brydon*, 286.
Telescope Spider Design, Improved, *C. H. Werenskiold*, 268.
Telescope, The 200-inch, 316.
Thanksgiving Day, 151.
Thiessen, A. D., Her Majesty's Magnetical and Meteorological Observatory, Toronto, 141, 205.
Tidal Attack on the Cepheid Problem, A, *William A. Luby*, 293.
Time in Bible Times, *Charles Francis Potter*, 163.
Topham, Bert, First Award of Chant Medal to, 91.
Transit of Mercury, 1940, November 11, 42; *H. Boyd Brydon and R. M. Petrie*, 6; Victoria Observations, *K. O. Wright*, 1.
Tree Rings, Sun-spots and, *Edwin Lincoln Moseley*, 376.
Two Useful Telescope Accessories, *H. Boyd Brydon*, 307.
Tycho's Nova, Beza's Verses on, *Thomas L. MacDonald*, 366.

U

Unconquerable Spirit of Britain, The, 41.
U.S.S.R., A New Book on Meteors Published in the, 84.
U.S.S.R., First Catalogue of Fireballs Observed in the, 39.

V

Variable Stars, Visual Photometry of, *H. Boyd Brydon*, 20, 153, 249.
Victoria Observations of the Transit of Mercury, 1940, November 11, *K. O. Wright*, 1.
Victoria, 1941 — Summer Evenings with the Stars, *K. O. Wright*, 438.
Visual Photometry of Variable Stars, *H. Boyd Brydon*, 20, 153, 249.

W

War and the D.D.O. Staff, The, 86.
Wates, Cyril G., A Hindle Type Grinding Machine, 33.
Weather, The Moon and the, *C. A. Chant*, 227, 278.
Weir, James (obituary) *C. A. Chant*, 203.
Werenskiold, C. H., Improved Telescope Spider Design, 268.
What to do about Astrology, 371.
White, C. E., Calendar Reform, 343; Perpetual and Mental Calendars, 233; Perpetual Ecclesiastical Calendars, 241.
Wright, K. O., A Bibliography of the Published Papers of J. S. Plaskett (with C. S. Beals and R. M. Petrie) 408; Summer Evenings with the Stars—Victoria, 1941, 438; Victoria Observations of the Transit of Mercury, 1940, November 11, 1.

Y

Yerkes Observatory, Founding of the, 434.
Young, R. K. (see Notes and Queries and Reviews).

Z

Zeno Paradox in Himalayan Mountain Climbing, A, 357.

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CONTENTS FOR VOLUME XXXV, 1941

I. JANUARY

Victoria Observations of the Transit of Mercury, 1940 November 11 (with Plate I)....*K. O. Wright* 1
The 1940 Transit of Mercury (with Plate II) *H. Boyd Brydon and R. M. Petrie* 6
John Beattie Cannon, M.A., 1879-1940....*T. H. Parker* 15
Visual Photometry of Variable Stars (continued)....*H. Boyd Brydon* 20
A Hindle Type Grinding Machine (with Plates III, IV)..*Cyril G. Wates* 33
Meteor News (First Catalogue of Fireballs Observed in the U.S.S.R.) *P.M.M.* 39
Notes and Queries (The Unconquerable Spirit of Britain; The Experiences of an Astronomer; *C.A.C.* British Astronomy and the War; *F.S.H.* Transit of Mercury, 1940 November 11; *R.J.N.* Another Astronomical Society; Ernest William Brown, 1866-1938; *C.A.C.*.... 41
Meetings of the Society—Winnipeg, Toronto, Victoria.... 45

II. FEBRUARY

Comet Cunningham, 1940c....*Ruth J. Northcott* 49
The 1939-40 Apparition of Jupiter..*Walter H. Haas and Hugh M. Johnson* 53
The Interstellar Absorption Lines of Molecular Origin....*P. Swings* 71
Mars in 1939 as seen through a Four-inch Telescope (with Plate V) *DeLisle Garneau* 81
Meteor News (A New Book on Meteors Published in the U.S.S.R.) *P.M.M.* 84
Review of Publications (*Spectra of Long-Period Variable Stars*, by Paul W. Merrill; *F.S.H.*).... 85
Notes and Queries (Staff of the Dominion Astrophysical Observatory; *C.A.C.* The War and the D.D.O. Staff; *R.K.Y.*).... 86
Meetings of the Society—Toronto.... 87

III. MARCH

Annual At-Home of the Royal Astronomical Society of Canada (with Plates VI, VII):
The Chant Medal—First Award to Bertram J. Topham.... 89
Reply by Mr. Topham.... 93
Presentation of Facsimile to Prof. C. A. Chant—Mr. Andrew Thomson's Address and Professor Chant's Reply.... 94
Recollection of Astronomy in Canada, by Prof. Chant.... 97
Experimental Demonstrations by Prof. Ainslie.... 104
Annual General Meeting of the Royal Astronomical Society of Canada: Reports of the Recorder, General Secretary, Librarian, Secretaries of the Centres, General Treasurer, Treasurers of the Centres for 1941 105
Recently Elected Members at Large.... 127
Notes and Queries (Sparkling Sirius; The last Sun-spot Maximum; Red Rays and Fogs; *C.A.C.*).... 128
Meetings of the Society—Toronto, Vancouver, Winnipeg, Ottawa.... 130
A Greek Astronomer's Appeal.... 136

IV. APRIL

Sir Frederic Stupart (with Plate VIII) ..... *C. A. Chant* 137
Her Majesty's Magnetical and Meteorological Observatory, Toronto ..... *A. D. Thiessen* 141
Thanksgiving Day—Statement from the Public Archives of Canada 151
The Visual Photometry of Variable Stars (continued) ..... *H. Boyd Brydon* 153
Time in Bible Times ..... *Charles Francis Potter* 163
Charting the Planetary Phenomena ..... *Sylvan Harris* 169
The Observing of Aurorae ..... *Ruth J. Northcott* 173
Notes and Queries (Cyrene: Birthplace of Eratosthenes; Doctors and Doctors; Remarkable Observations, to say the Least; Stones from Heaven—by Plutarch; *C.A.C.*) 177
Meetings of the Society—Winnipeg, Toronto 180

V. MAY-JUNE

The 1939-40 Apparition of Mars (with Plates IX, X) ..... *H. M. Johnson and W. H. Haas* 185
James Weir of McGill University ..... *C. A. Chant* 203
Her Majesty's Magnetical and Meteorological Observatory, Toronto (continued) ..... *A. D. Thiessen* 205
Robert Henley Combs ..... *E. J. A. Kennedy* 225
The Moon and the Weather (from a radio talk)—Sunrise from an Aeroplane ..... *C.A.C.* 227
Notes and Queries (Mount Wilson Observatory, Report for 1940; Mathematics in King Charles II's Time; A New Iron Meteorite; Four Calendars in Egypt; *C.A.C.* Personal Note; *J.A.P.*) 229
Meetings of the Society—Winnipeg 232

VI. JULY-AUGUST

Perpetual and Mental Calendars ..... *C. E. White* 233
Perpetual Ecclesiastical Calendars ..... *C. E. White* 241
The Visual Photometry of Variable Stars (conclusion) ..... *H. Boyd Brydon* 249
Improved Telescope Spider Design ..... *C. H. Werenskiold* 268
An Early Reference to an Astronomical Event Comes to Light (with Plate XI) ..... *W. Kenneth Angus* 271
Review of Publications (*The Analytical Foundations of Celestial Mechanics*, by Aurel Wintner; *A. F. Stevenson*) 273
Notes and Queries (Morehouse and His Comet; A Research Physicist's Views on Education; The Moon and the Weather; Personal Notes; *C.A.C.*) 274
Meetings of the Society—Victoria 280

VII. SEPTEMBER

The Role of Mathematics in Astronomy ..... *Alfred T. DeLury* 281
Compass Directions in the Telescope ..... *H. Boyd Brydon* 286
Amateurs and Handbooks ..... *W. S. Houston* 289
A Tidal Attack on the Cepheid Problem ..... *William A. Luby* 293
Two Useful Telescope Accessories ..... *H. Boyd Brydon* 307
American Association of Variable Star Observers—Thirtieth Annual Spring Meeting ..... *D. W. Rosebrugh* 312
Review of Publications (*Barlow's Tables*, revised by L. J. Comrie; *C.A.C.*) 314

Notes and Queries (A New Calendar: When Shall we have it? The 200-inch Telescope; Noise and Quiet; *C.A.C.*) 315
Meetings of the Society—Victoria 318

VIII. OCTOBER

The Interior of the Earth viewed in its Relation to Earthquake Causes: the Viewpoint of Seismology ..... *E. A. Hodgson* 321
North Temperate Belt, Markings on Jupiter in 1940-41 ..... *H. M. Johnson* 330
A Recalibration of the Standard Lamps of the Dominion Astrophysical Observatory ..... *A. McKellar and R. M. Petrie* 337
Calendar Reform ..... *C. E. White* 343
Astronomical Graph Sheets ..... *J. W. Campbell* 353
Notes and Queries (J. Edward Maybee (1866-1941); *J.R.C.* A Zeno Paradox in Himalayan Mountain Climbing; Great Auroral Display; Death of John S. Plaskett; *C.A.C.*) 356
Notice Regarding the Chant Medal 359

IX. NOVEMBER

The Depression of Lunar Craters ..... *R. A. McIntosh* 361
Beza's Verses on Tycho's Nova ..... *T. L. MacDonald* 366
Auroral Display and Geomagnetic Storm of September 18-19, 1941 ..... *A. G. McNish* 368
What to do about Astrology ..... *Scientific American* 371
Thirtieth Annual Meeting of A.A.V.S.O. ..... *D. W. Rosebrugh* 374
Sun-spots and Tree Rings ..... *E. L. Moseley* 376
Review of Publications (*Between the Planets*, by Fletcher G. Watson; *C.A.C. The Milk Way*, by Bart J. Bok and Priscilla F. Bok; *H.B. S.H. The Fundamental Properties of the Galactic System*, Annals of N.Y. Academy of Sciences; *R.K.Y.*) 393
Notes and Queries (Science and Faith; "Astronomy"; *C.A.C.*) 396
Meetings of the Society—Toronto 398
Fireball of October 22, 1941: Information Wanted 400

X. DECEMBER

John Stanley Plaskett (with Plate XII) ..... *C. S. Beals* 401
A Bibliography of the Published Papers of J. S. Plaskett ..... *C. S. Beals, R. M. Petrie, K. O. Wright* 408
J. S. Plaskett at the University of Toronto (with Plate XIII) ..... *C. A. Chant* 412
The Satellites of Jupiter (with Plate XIV) ..... *Seth B. Nicholson* 415
Mars, la Planète étrange ..... *Albéric Boivin* 421
Henry Allen McTaggart ..... *E. F. Burton* 428
Review of Publications (*Observations of Mars and its Canals*, by Harold B. Webb; *Hugh M. Johnson. Sky and Telescope; F.S.H.*) 431
Notes and Queries (The Quebec Astronomical Society; Death of G. Parry Jenkins; Founding of the Yerkes Observatory; Removal of Reflections from the Surface of Lenses; *C.A.C.*) 433
Meetings of the Society—Winnipeg 437
Summer Evenings with the Stars—Victoria, 1941 ..... *K. O. Wright* 438
Index to Volume XXXV 441

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